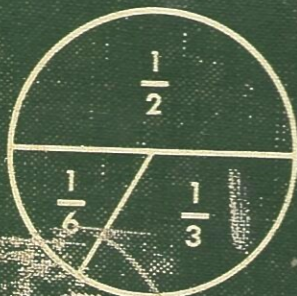


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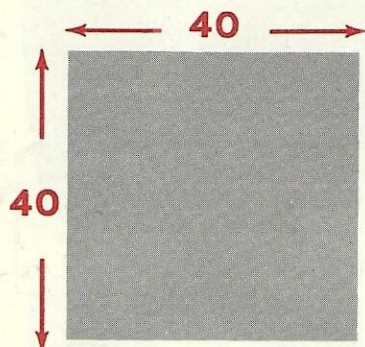
$$\begin{array}{r} 7 \\ 9 \overline{) 63} \end{array}$$

EXPLORING

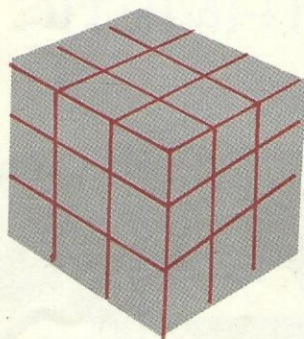
# Arithmetic







| COLE DRUG STORE           |            |       |
|---------------------------|------------|-------|
| SOLD TO: <i>TOM HICKS</i> |            |       |
| NO.                       | ITEM       | PRICE |
| 1                         | toothbrush | .33   |
| 2                         | bars soap  | .39   |
| TOTAL                     |            |       |



1 CU. YD.



1 CU. FT.



EXPLORING

# Arithmetic

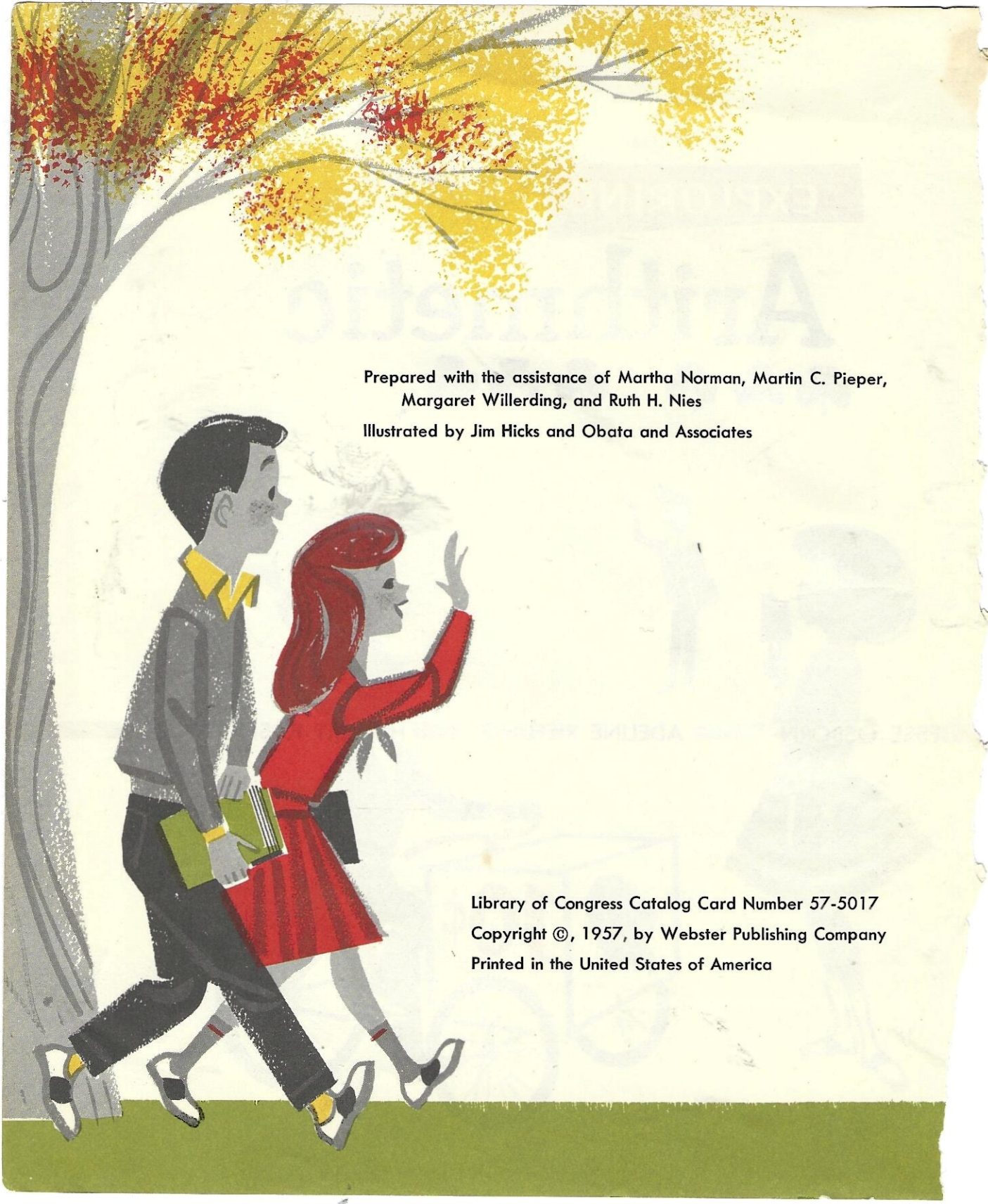


JESSE OSBORN

ADELIN RIEFLING

HERBERT F. SPITZER



An illustration of a young man and woman walking together. The man is on the left, wearing a grey sweater over a yellow collared shirt and dark trousers, carrying a green book. The woman is on the right, wearing a red dress and white shoes, with her hand raised as if waving or gesturing. They are walking on a green path. Above them is a large tree with branches covered in yellow and red autumn leaves. The background is a light, textured cream color.

Prepared with the assistance of Martha Norman, Martin C. Pieper,  
Margaret Willerding, and Ruth H. Nies

Illustrated by Jim Hicks and Obata and Associates

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## A. One, two

|     |     |           |           |                 |
|-----|-----|-----------|-----------|-----------------|
| I   | II  | II I      | II II     | II II I         |
| (1) | (2) | (2 and 1) | (two 2's) | (two 2's and 1) |

## B. One, two, three

|     |     |     |           |           |           |                 |     |             |     |     |
|-----|-----|-----|-----------|-----------|-----------|-----------------|-----|-------------|-----|-----|
| I   | II  | III | III I     | III II    | III III   | III III I       | ?   | III III III | ?   | ?   |
| (1) | (2) | (3) | (3 and 1) | (3 and 2) | (two 3's) | (two 3's and 1) | (?) | (three 3's) | (?) | (?) |

**How Number Systems Were Made**

Did you ever wonder how people first learned to use numbers? Many thousands of years ago, people must have done their counting in very simple ways.

To answer such a question as "How many sheep?" a shepherd perhaps laid down a pebble for each sheep. The only way he could say how many would be to point to the pile of pebbles.

When people needed to refer to a number of things, they had to invent a number system. One way we can guess how early man began to do this is to study uncivilized peoples in remote places today.

1. One such tribe counts, "One, two," and then for 3 says, "Two and one." What would these people say for 4? For 5? See A above.

2. On what number do these people build, or **base**, numbers larger than 2?

3. How far can they count with words for only 1 and 2? After this, such people would say, "Many."

4. Some ancient peoples said, "One, two, three," and then built on the **base** of 3. How far could such peoples count with words for only 1, 2, and 3? See B above.

5. We know that some ancient peoples used 5 as a base for their number system, probably because they had five fingers on one hand. With 5 as a base, show how far they could count without using new number words.

6. Our number system is based on 10. Eleven is 10 and 1; 12 is 10 and 2. Where do you think we got our words for 13 through 19?

7. Can you guess where we got our words twenty, thirty, and so on? In a number system based on 10 how high do you think we can count before we need new words?



## Understanding Our Number System

| millions  | hundred thousands | ten thousands | thousands | hundreds | tens | ones |
|-----------|-------------------|---------------|-----------|----------|------|------|
| 1,000,000 | 100,000           | 10,000        | 1000      | 100      | 10   | 1    |

When men began to trade and to measure land and other things, they needed larger numbers. Then people began to use the fingers of both hands as counters. With ten fingers they could show the numbers from one through ten.

With ten as a base, they could build any number higher than ten. This way of counting was so useful that today we, and the people of all other highly civilized nations, count by tens.

1. Explain how 10 is used in the table of numbers at the top of the page. Begin with ones.

2. How many figures, or **digits**, do we use to write our numbers? What are they?

3. What plan do we use to write two-place numbers like 17, 12, 49?

4. Which digit is never read when we read large numbers? Reading these numbers will help you.

10,526,038    2200    15,504

5. In the number 2200 what is the value of each 2? What does

each zero show? Look at Sue's work before you answer.

|     |           |   |   |   |
|-----|-----------|---|---|---|
| SUE | thousands |   |   |   |
|     | hundreds  |   |   |   |
|     | tens      |   |   |   |
|     | ones      |   |   |   |
|     | 2         | 0 | 0 | 0 |
|     | 2         | 0 | 0 |   |
|     |           | 0 | 0 |   |
|     |           |   | 0 |   |
|     |           |   |   | 2 |
|     |           |   |   | 2 |
|     |           |   |   | 0 |
|     |           |   |   | 0 |

6. Jim forgot to write the zeros when he intended to write 2200. Instead he wrote 22. Do the 2's in Jim's number have the same value as the 2's in 2200? Explain. Why can you say the zeros in 2200 are **place-holders**?

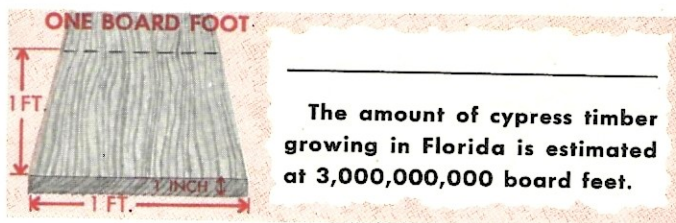
7. "Are digits other than zero also place-holders?" asked Ann. How would you answer her?

8. In the number 1,526,079 what digit, or figure, holds millions place? Hundreds place?

9. Besides knowing the digit names and the place value of digits, what other names must you know to read large numbers?



## Reading Large Numbers



1. Jack prepared a report on cypress timber. In a magazine, he found the statement above. Is the number given 3 million or 3 billion?

2. Jack knew that the area of the United States was a little more than 3 million square miles. He looked up the exact area, and found this figure: 3,022,387 sq. mi. How does this help answer question 1?

3. To read large numbers, you have to know the name of each place in the number. What is the name of the place in which the 3 is written in the number 1,346,289?

4. Read the two numbers in the chart at the bottom of this page. Notice that the figures are arranged in groups called **periods**.

Do you read the name of the period before or after you read the number in the period?

5. The bottom number in the chart is read, "115 billion, 45 thousand, 500." Are the figures in each period read in the same way?

6. In reading numbers, which period name is not given?

Read these numbers. Use the chart if you need it.

7. 64,214,510      76,300,009,000

8. 1,035,651,809      786,081,483

9. 325,857,201,008

■ **To read any large number**, read the number in the period. Then give the period name, except the last one.

| Number-Reading Chart   |          |          |           |          |
|------------------------|----------|----------|-----------|----------|
| PERIOD NAME            | billions | millions | thousands | ones     |
| PLACE NAMES IN PERIODS | hundreds | hundreds | hundreds  | hundreds |
|                        | tens     | tens     | tens      | tens     |
|                        | ones     | ones     | ones      | ones     |
|                        | 17,      | 314,     | 986,      | 502      |
|                        | 115,     | 008,     | 045,      | 500      |



## Other Ways to Study Large Numbers



1. On the place-value chart below, marks have been used instead of figures to show the different numbers. Write with figures the five numbers given on the chart.

| Place-Value Chart |              |          |                  |              |          |                   |               |           |          |
|-------------------|--------------|----------|------------------|--------------|----------|-------------------|---------------|-----------|----------|
| hundred billions  | ten billions | billions | hundred millions | ten millions | millions | hundred thousands | ten thousands | thousands | hundreds |
|                   |              |          |                  |              |          |                   |               |           |          |
|                   |              |          |                  |              |          |                   |               |           |          |
|                   |              |          |                  |              |          |                   |               |           |          |
|                   |              |          |                  |              |          |                   |               |           |          |
|                   |              |          |                  |              |          |                   |               |           |          |

2. When you wrote the first number shown on the place-value chart above, what did you do to make your figures show that the 4 marks mean 4 billion?

3. How many figures did you use to write the second number on the place-value chart? How many of the figures were zeros? Why?

4. When you write an exact number of billions, how many zeros

do you always put at the right of the billions period?

5. On the place-value chart the value of a mark depends on the place where the mark is written. How is the writing of our numbers very much like the showing of numbers on this place-value chart? Study the following numbers before you answer.

- 2—two ones
- 20—two tens or twenty
- 200—two hundred
- 2,000—two thousand
- 20,000—twenty thousand
- 200,000—two hundred thousand
- 2,000,000—two million
- 20,000,000—twenty million
- 200,000,000—two hundred million
- 2,000,000,000—two billion

Write what the 5 means in each of these numbers.

- 6. 600,245,341,987     9,412,254,236
- 7. 215,361,098,000     852,091,629
- 8. 651,200,817,473     9,146,974,518

■ The meaning, or **value**, of a figure depends on its place, or **position**, in a number. Its position tells its place value.



The following statements were made during a TV newscast. Write the number in each statement with figures.

9. The national debt at one time was eighty-six billion dollars.

10. The earth removed from a diamond mine is three hundred twenty million times as heavy as the diamonds removed.

11. The General Business Company is worth two billion, forty million, seven hundred thousand dollars.

12. Which of these numbers is easier to read? Why?

10624427904    10,624,427,904

13. How many commas are used if you use figures and commas in writing one hundred ten billion?

■ Numbers of more than four places are usually **pointed off**, or written in groups of three figures each. The group at the left in a number may have fewer than three figures. The groups are called **periods**. Begin at the **right** of a number when pointing off into periods.

Copy. Point off into periods.

14. 58625431056    140098230157

15. 8290042850    392100600

16. 400068920    190672000

17. Why is the number 17 million sometimes called a **three-period** number and sometimes an **eight-place** number?

18. Write a four-period number that has 12 places; one that has 10 places.

19. How many times do you say the word "hundred" in reading the number 316,437,125?

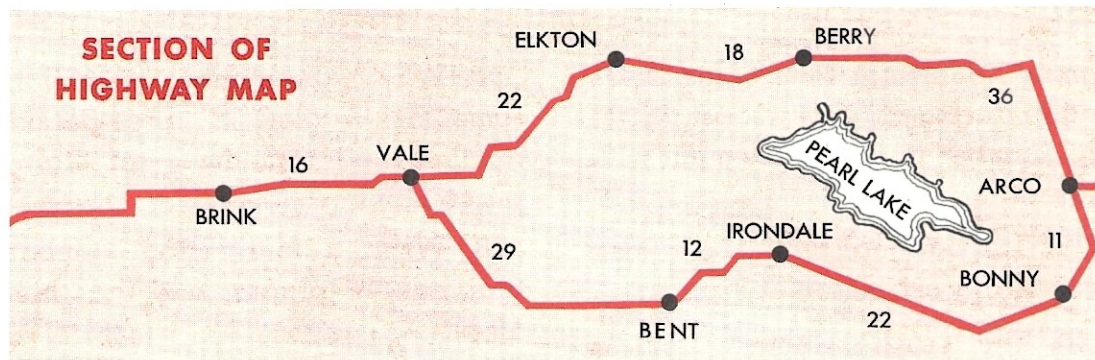
20. Read the numbers shown on this place-value chart.

| Place-Value Chart |              |          |                  |              |          |                   |               |           |          |      |      |
|-------------------|--------------|----------|------------------|--------------|----------|-------------------|---------------|-----------|----------|------|------|
| hundred billions  | ten billions | billions | hundred millions | ten millions | millions | hundred thousands | ten thousands | thousands | hundreds | tens | ones |
|                   |              |          |                  |              | 4        | 0                 | 0             | 0         | 0        | 0    | 0    |
|                   |              | 4        | 0                | 0            | 0        | 0                 | 0             | 0         | 0        | 0    | 0    |
|                   |              |          |                  |              |          | 4                 | 0             | 0         | 0        | 0    | 0    |
|                   |              |          | 4                | 0            | 0        | 0                 | 0             | 0         | 0        | 0    | 0    |

21. Draw a place-value chart. On it write the numbers used in examples 9, 10, 11, 13, and 14 on this page.

 Bring magazine and newspaper clippings that contain numbers with more than four places. Be ready to read them to the class.





### Fast Addition of Two-Figure Numbers

Bob and Ruth's family are now at Brink. They want to drive on to Arco. "Which road is shorter, the one through Elkton, or the one through Bent?" asked their father.

1. Bob wrote the numbers shown here. Where did he find these numbers?

|     |            |            |
|-----|------------|------------|
| BOB | 16         | 16         |
|     | 22         | 29         |
|     | 18         | 12         |
|     | <u>+36</u> | <u>22</u>  |
|     |            | <u>+11</u> |

2. Before Bob could add the numbers he wrote, Ruth said, "It is 2 miles shorter to go by way of Bent."

"How did you get the sums so quickly?" asked Bob.

"When I added, I added two columns at once," said Ruth. This is how Ruth added.

$$16 + 20 \text{ (20 from 22) is 36.}$$

$$36 + 2 \text{ (2 is rest of 22) is 38.}$$

$$38 + 10 \text{ (10 from 18) is 48.}$$

$$48 + 8 \text{ (8 is rest of 18) is 56.}$$

$$56 + 30 \text{ (30 from 36) is 86.}$$

$$86 + 6 \text{ (6 is rest of 36) is 92.}$$

For the other addition, Ruth added like this.

$$16 + 20 \text{ (20 from 29) is 36.}$$

$$36 + 9 \text{ (9 is rest of 29) is 45.}$$

$$45 + 10 \text{ (10 from 12) is 55.}$$

$$55 + 2 \text{ (2 is rest of 12) is 57.}$$

$$57 + 20 \text{ (20 from 22) is 77.}$$

$$77 + 2 \text{ (2 is rest of 22) is 79.}$$

$$79 + 10 \text{ (10 from 11) is 89.}$$

$$89 + 1 \text{ (1 is rest of 11) is 90.}$$

90 is 2 less than 92, so the distance is 2 miles less by way of Bent.

3. Try Ruth's way of adding the numbers at the right. You do not have to say "from 14" and "from 22." Check your sum by adding up.

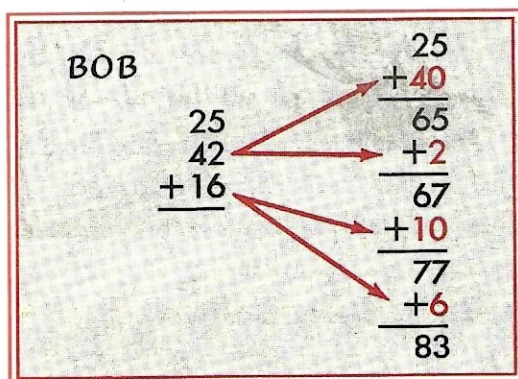
|            |
|------------|
| 23         |
| 14         |
| <u>+22</u> |



## Adding the Tens Part First

After doing example 3 on page 6, Bob found that he could give a shorter explanation of Ruth's fast addition of two-figure numbers. This was his explanation.

To add a two-figure number, add the tens part of the number first. Next add the ones part of the number. Then add the next addend in the same way.



Use this way of adding to find the answers for rows 1 and 2.

1.  $\begin{array}{r} 35 \\ 21 \\ +33 \\ \hline \end{array}$   $\begin{array}{r} 17 \\ 41 \\ +12 \\ \hline \end{array}$   $\begin{array}{r} 52 \\ 17 \\ +25 \\ \hline \end{array}$   $\begin{array}{r} 16 \\ 24 \\ +46 \\ \hline \end{array}$   $\begin{array}{r} 28 \\ 35 \\ +14 \\ \hline \end{array}$

2.  $\begin{array}{r} 32 \\ 14 \\ 22 \\ +24 \\ \hline \end{array}$   $\begin{array}{r} 21 \\ 32 \\ 15 \\ +23 \\ \hline \end{array}$   $\begin{array}{r} 14 \\ 43 \\ 32 \\ +15 \\ \hline \end{array}$   $\begin{array}{r} 31 \\ 25 \\ 42 \\ +34 \\ \hline \end{array}$   $\begin{array}{r} 23 \\ 15 \\ 51 \\ +26 \\ \hline \end{array}$

3. Here is Ruth's way of adding the last example in row 2.

$$23 + 10 \text{ (10 from 15) is 33.}$$

$$33 + 5 \text{ (5 from 15) is 38.}$$

$$38 + 50 \text{ (50 from 51) is 88.}$$

$$88 + 1 \text{ (1 from 51) is 89.}$$

$$89 + 20 \text{ (20 from 26) is 109.}$$

$$109 + 6 \text{ (6 from 26) is 115.}$$

Did you use the steps that are given here?

4. Check each of your sums by adding each column of figures from the bottom upwards.

5. When you check your sums by adding, you add ones column first. How is this different from Ruth's quick way of adding?

6. In what order do you usually add the columns of figures in an addition example?

7. When would you be more likely to use Ruth's fast way of adding: when you are using a pencil to write your sums, or when you are adding without a pencil? Why?

8. Explain why it can be said that in Ruth's way you are adding both columns of figures at the same time.

## Addition Tapping Tests

Do you know your basic addition facts well enough to say them correctly and promptly? Find out for yourself by doing the tapping test below.

Say to yourself the sum of each pair of numbers as soon as you look at them. Touch, or tap, the edge of your book as you say each sum.

### Addition Tapping Test One

1.  $\begin{array}{r} 7 \\ +6 \\ \hline \end{array}$   $\begin{array}{r} 5 \\ +4 \\ \hline \end{array}$   $\begin{array}{r} 6 \\ +9 \\ \hline \end{array}$   $\begin{array}{r} 4 \\ +9 \\ \hline \end{array}$   $\begin{array}{r} 8 \\ +7 \\ \hline \end{array}$   $\begin{array}{r} 9 \\ +5 \\ \hline \end{array}$
2.  $\begin{array}{r} 6 \\ +5 \\ \hline \end{array}$   $\begin{array}{r} 8 \\ +0 \\ \hline \end{array}$   $\begin{array}{r} 5 \\ +7 \\ \hline \end{array}$   $\begin{array}{r} 9 \\ +7 \\ \hline \end{array}$   $\begin{array}{r} 8 \\ +5 \\ \hline \end{array}$   $\begin{array}{r} 7 \\ +0 \\ \hline \end{array}$
3.  $\begin{array}{r} 8 \\ +9 \\ \hline \end{array}$   $\begin{array}{r} 6 \\ +4 \\ \hline \end{array}$   $\begin{array}{r} 5 \\ +6 \\ \hline \end{array}$   $\begin{array}{r} 4 \\ +7 \\ \hline \end{array}$   $\begin{array}{r} 9 \\ +8 \\ \hline \end{array}$   $\begin{array}{r} 8 \\ +4 \\ \hline \end{array}$
4.  $\begin{array}{r} 7 \\ +9 \\ \hline \end{array}$   $\begin{array}{r} 9 \\ +0 \\ \hline \end{array}$   $\begin{array}{r} 9 \\ +6 \\ \hline \end{array}$   $\begin{array}{r} 9 \\ +4 \\ \hline \end{array}$   $\begin{array}{r} 8 \\ +6 \\ \hline \end{array}$   $\begin{array}{r} 7 \\ +5 \\ \hline \end{array}$
5.  $\begin{array}{r} 5 \\ +8 \\ \hline \end{array}$   $\begin{array}{r} 3 \\ +9 \\ \hline \end{array}$   $\begin{array}{r} 6 \\ +7 \\ \hline \end{array}$   $\begin{array}{r} 3 \\ +8 \\ \hline \end{array}$   $\begin{array}{r} 6 \\ +8 \\ \hline \end{array}$   $\begin{array}{r} 7 \\ +8 \\ \hline \end{array}$
6.  $\begin{array}{r} 4 \\ +6 \\ \hline \end{array}$   $\begin{array}{r} 7 \\ +4 \\ \hline \end{array}$   $\begin{array}{r} 9 \\ +9 \\ \hline \end{array}$   $\begin{array}{r} 0 \\ +7 \\ \hline \end{array}$   $\begin{array}{r} 8 \\ +9 \\ \hline \end{array}$   $\begin{array}{r} 7 \\ +7 \\ \hline \end{array}$

■ An **addition fact** is any addition question and its answer.

■ A **basic addition fact** is an addition fact in which a one-figure number is added to another one-figure number, or to itself.

To be able to add two columns of figures at the same time, as on page 7, you have to know your basic addition facts well.

If your saying of the sums and your tapping were regular and reasonably fast, you know the basic addition facts well.

If your tapping was not regular, or was too slow, turn to page 319 and study the facts given there. In your study, use one or all of the study suggestions on the next page.

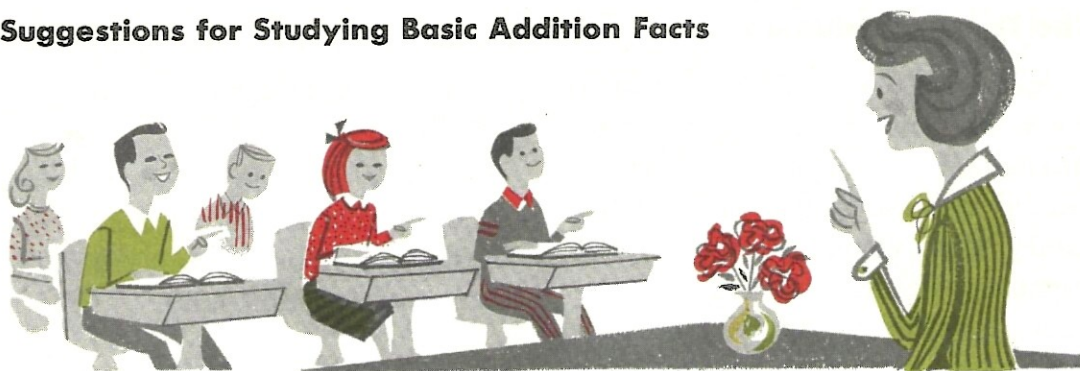
After you think your addition of the basic facts has improved, try this second tapping test.

### Addition Tapping Test Two

7.  $\begin{array}{r} 3 \\ +9 \\ \hline \end{array}$   $\begin{array}{r} 4 \\ +5 \\ \hline \end{array}$   $\begin{array}{r} 4 \\ +9 \\ \hline \end{array}$   $\begin{array}{r} 6 \\ +8 \\ \hline \end{array}$   $\begin{array}{r} 5 \\ +5 \\ \hline \end{array}$   $\begin{array}{r} 5 \\ +9 \\ \hline \end{array}$
8.  $\begin{array}{r} 6 \\ +3 \\ \hline \end{array}$   $\begin{array}{r} 7 \\ +4 \\ \hline \end{array}$   $\begin{array}{r} 5 \\ +8 \\ \hline \end{array}$   $\begin{array}{r} 2 \\ +9 \\ \hline \end{array}$   $\begin{array}{r} 6 \\ +5 \\ \hline \end{array}$   $\begin{array}{r} 6 \\ +2 \\ \hline \end{array}$
9.  $\begin{array}{r} 2 \\ +3 \\ \hline \end{array}$   $\begin{array}{r} 7 \\ +8 \\ \hline \end{array}$   $\begin{array}{r} 8 \\ +4 \\ \hline \end{array}$   $\begin{array}{r} 3 \\ +7 \\ \hline \end{array}$   $\begin{array}{r} 6 \\ +4 \\ \hline \end{array}$   $\begin{array}{r} 3 \\ +3 \\ \hline \end{array}$
10.  $\begin{array}{r} 2 \\ +8 \\ \hline \end{array}$   $\begin{array}{r} 6 \\ +6 \\ \hline \end{array}$   $\begin{array}{r} 5 \\ +2 \\ \hline \end{array}$   $\begin{array}{r} 3 \\ +4 \\ \hline \end{array}$   $\begin{array}{r} 3 \\ +5 \\ \hline \end{array}$   $\begin{array}{r} 4 \\ +2 \\ \hline \end{array}$
11.  $\begin{array}{r} 7 \\ +2 \\ \hline \end{array}$   $\begin{array}{r} 4 \\ +4 \\ \hline \end{array}$   $\begin{array}{r} 5 \\ +7 \\ \hline \end{array}$   $\begin{array}{r} 9 \\ +9 \\ \hline \end{array}$   $\begin{array}{r} 7 \\ +7 \\ \hline \end{array}$   $\begin{array}{r} 7 \\ +6 \\ \hline \end{array}$
12.  $\begin{array}{r} 6 \\ +9 \\ \hline \end{array}$   $\begin{array}{r} 8 \\ +8 \\ \hline \end{array}$   $\begin{array}{r} 2 \\ +2 \\ \hline \end{array}$   $\begin{array}{r} 8 \\ +9 \\ \hline \end{array}$   $\begin{array}{r} 3 \\ +8 \\ \hline \end{array}$   $\begin{array}{r} 7 \\ +9 \\ \hline \end{array}$



## Suggestions for Studying Basic Addition Facts



1. Read a fact carefully. Then close your eyes, or look away. Think the fact. Say it to yourself or write it. Then look at the fact. Is it exactly as you thought it? If it is not, read, think, and say or write the fact again.

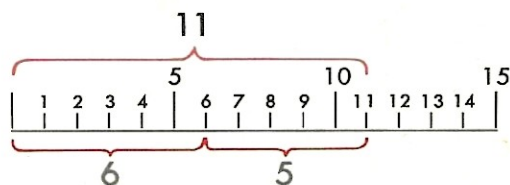
2. Cut a notched piece of paper for use when you study facts. Cover the sum with the notched piece of paper, as shown here.

|    |    |    |    |    |
|----|----|----|----|----|
| 6  | 8  | 9  | 7  | 9  |
| +4 | +8 | +9 | +5 | +7 |
| 10 | 16 | 18 | 12 |    |

Try to give the covered sum. Then move the paper. See if the answer you gave is correct. If you find your answer is wrong, study the fact as explained in suggestion 1 above.

3. Make number-line drawings to show facts you do not know well.

Here is a number-line drawing showing  $6 + 5 = 11$ .



4. Write all of the basic addition combinations. Use the tapping test to see if you can give the sums smoothly and reasonably fast. Try to shorten the time it takes you to give the right answers. That is, give the answers so your finger will tap much faster.

5. Write 10 addition facts in which 0 is added to a one-figure number, including 0. Write 9 addition facts in which a one-figure number is added to zero. Study the answers to the facts. Then write a rule for adding 0 to any number.

6. Write a rule for adding 1 to any number.

## The Terms of Addition

Jack kept a record of the cost of seeds he bought for his vegetable garden. He asked his teacher if he should use the dollar sign or the cents sign when he added the amounts. The teacher said, "If the sum is going to be less than a dollar, you may write the addends either way."

|      |               |    |            |
|------|---------------|----|------------|
| JACK | \$ .26        | or | 26¢        |
|      | .14           |    | 14¢        |
|      | + .08         |    | + 8¢       |
|      | <u>\$ .48</u> |    | <u>48¢</u> |

1. Which of the numbers Jack used above are addends? Which are sums?

■ In addition, the numbers to be added are called the **addends**. The answer is called the **sum**.

2. Jack bought some other things to use in his garden. He spent eighty-five cents, thirty cents, and fifty-five cents. Should Jack use the dollar sign or the cents sign to write these amounts?

3. Later Jack sold products from his garden. He kept a record of his sales each day. What were his total sales for the day on which he wrote this record: carrots, 85¢;

onions, 5¢; tomatoes, \$1.35; corn, \$2.10?

4. One day Jack counted his change. He found he had 167¢. Write this amount using the dollar sign and decimal point.

► Copy. Find the answers.

|    |            |           |            |            |            |
|----|------------|-----------|------------|------------|------------|
| 5. | 41         | 15        | 64         | 73         | 31         |
|    | 29         | 24        | 13         | 14         | 26         |
|    | 35         | 39        | 23         | 26         | 73         |
|    | 16         | 12        | 42         | 39         | 46         |
|    | <u>+12</u> | <u>+8</u> | <u>+18</u> | <u>+14</u> | <u>+39</u> |

|    |            |            |            |            |           |
|----|------------|------------|------------|------------|-----------|
| 6. | 16         | 98         | 76         | 75         | 80        |
|    | 52         | 40         | 67         | 44         | 92        |
|    | 17         | 12         | 41         | 40         | 71        |
|    | 17         | 9          | 52         | 5          | 13        |
|    | <u>+29</u> | <u>+19</u> | <u>+37</u> | <u>+46</u> | <u>+6</u> |

Henry wanted to check his sums.

He found the sum of the first three addends. Then he found the sum of the last two addends. He added these two sums together.

|       |            |            |
|-------|------------|------------|
| HENRY | 41         | } → 105    |
|       | 29         |            |
|       | 35         |            |
|       | 16         | } → +28    |
|       | +12        |            |
|       | <u>133</u> | <u>133</u> |

7. Study Henry's check. Use his way to check your answers for rows 5 and 6.



## Working with Carried Numbers

1. Mary wanted to find the sum of 963, 495, and 286. First, she wrote the numbers carefully in a column. She kept the ones of each addend in a straight column, the tens in a straight column, and the hundreds under each other, too.

Then Mary added. How did she get the 1 that she carried to tens place? What is the value of the 2 that she wrote above the column at the left?

|      | hundreds | tens   | ones |
|------|----------|--------|------|
| MARY | ②<br>9   | ①<br>6 | 3    |
|      | 4        | 9      | 5    |
|      | + 2      | 8      | 6    |
|      | 1 7      | 4      | 4    |

In the examples below find the missing numbers that are shown by question marks. The small question marks in the circles stand for carried numbers.

|                                                                          |                                                                        |                                                                                        |                                                                         |
|--------------------------------------------------------------------------|------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 2. $\begin{array}{r} \textcircled{?} \\ 67 \\ +98 \\ \hline \end{array}$ | $\begin{array}{r} \textcircled{?} \\ 350 \\ +60 \\ \hline \end{array}$ | $\begin{array}{r} \textcircled{?} \textcircled{?} \\ 69 \\ +437 \\ \hline \end{array}$ | $\begin{array}{r} \textcircled{1} \\ 654 \\ +836 \\ \hline \end{array}$ |
| $\begin{array}{r} 25 \\ \hline \end{array}$                              | $\begin{array}{r} 210 \\ \hline \end{array}$                           | $\begin{array}{r} 206 \\ \hline \end{array}$                                           | $\begin{array}{r} 2222 \\ \hline \end{array}$                           |

|                                                                                                         |                                                                                                       |                                                                                                       |                                                                                                      |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| 3. $\begin{array}{r} \textcircled{?} \textcircled{?} \\ 627 \\ 259 \\ 403 \\ +28 \\ \hline \end{array}$ | $\begin{array}{r} \textcircled{?} \textcircled{1} \\ 915 \\ 184 \\ 308 \\ +721 \\ \hline \end{array}$ | $\begin{array}{r} \textcircled{?} \textcircled{?} \\ 417 \\ 854 \\ 322 \\ +108 \\ \hline \end{array}$ | $\begin{array}{r} \textcircled{?} \textcircled{?} \\ 456 \\ 983 \\ 54 \\ +721 \\ \hline \end{array}$ |
| $\begin{array}{r} 2217 \\ \hline \end{array}$                                                           | $\begin{array}{r} 2222 \\ \hline \end{array}$                                                         | $\begin{array}{r} 2701 \\ \hline \end{array}$                                                         | $\begin{array}{r} 2222 \\ \hline \end{array}$                                                        |

4. Notice how Jane showed the numbers that she carried.

Jane checked her work by adding again. This time she wrote 2576 as her sum.

Which number is the correct sum, 1376 or 2576?

How had Jane made this mistake? How would circling her carried numbers have helped Jane?

JANE

$$\begin{array}{r} 12 \\ 268 \\ 345 \\ 624 \\ +139 \\ \hline 1376 \end{array}$$

5. Is Bob's answer correct? Did he have any numbers to carry? Why are they not shown?

Many students, like Bob, are able to carry without writing the carried numbers. Do the additions below. Try to remember the numbers you carry without writing them. If you find that you cannot do this, write them. Be sure to circle them.

BOB

$$\begin{array}{r} 175 \\ 386 \\ +109 \\ \hline 670 \end{array}$$

|                                                                       |                                                                    |                                                                    |                                                                    |
|-----------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------|
| 6. $\begin{array}{r} 234 \\ 195 \\ 988 \\ +105 \\ \hline \end{array}$ | $\begin{array}{r} 347 \\ 537 \\ 674 \\ +380 \\ \hline \end{array}$ | $\begin{array}{r} 690 \\ 572 \\ 894 \\ +683 \\ \hline \end{array}$ | $\begin{array}{r} 814 \\ 329 \\ 764 \\ +742 \\ \hline \end{array}$ |
|-----------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------|

|                                                                                    |                                                                                 |                                                                                 |
|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| 7. $\begin{array}{r} \$3.09 \\ 6.41 \\ .59 \\ 4.33 \\ +2.43 \\ \hline \end{array}$ | $\begin{array}{r} \$7.99 \\ 8.03 \\ 7.11 \\ .75 \\ +6.05 \\ \hline \end{array}$ | $\begin{array}{r} \$4.32 \\ .72 \\ 5.76 \\ 4.90 \\ +9.01 \\ \hline \end{array}$ |
|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------|

- I. Without a pencil, add 4's one at a time to each of the following numbers. Stop when you reach a 60 number. Write this 60 number as your sum.

27    18    43

- II. Add 7's one at a time to each of the following numbers. Stop when you reach an 80 number. Write this 80 number as your sum.

26    31    19

### Addition Study Helps

Some pupils in grade six could not add columns very well. To help them improve in column addition, these pupils were doing the exercises shown on the board.

1. For exercise I, one girl wrote the sums 61, 62, and 61. Did she make any mistakes?

2. What numbers would this girl have written if she had the correct answers for exercise II?

Doing exercises like I and II will help to improve your addition. Joan said adding 4's or 7's one at a time is just like counting by 4's or 7's.

3. Was Joan right? Begin at 17. Count by 4's until you get to the first 50 number.

4. Begin at 36. Count by 8's until you get to the first 100 number.

5. Count by 6's from 18 to the

first number you reach in the 50's.

6. Count by 5's from 19 to the first 50 number that you reach.

For each row below decide whether you are to count by 4's, 5's, 6's, or some other number. Then on your paper write all the numbers for each row.

7. 51, 57, , , , , .

8. 42, 51, , , , , .

9. 59, 63, , , , , .

10. 36, 41, , , , , .

11. 60, 67, , , , , .

12. 16, 22, , , , , .

13. 24, 33, , , , , .

14. 15, 23, , , , , .

15. 37, 45, , , , , .

16. 28, 36, , , , , .

17. 54, 57, , , , , .



## Checking Your Addition

"I always check when I add," said Judy. "The first time I add, I begin at the top of the column and add down. To make sure I made no mistake, I add from the bottom of the column up. I compare the sums. If they are not the same, I add again to correct my mistake."

► Use folded paper. Find the answers. Check as Judy explained.

1.
 

|           |
|-----------|
| 8         |
| 6         |
| 3         |
| 4         |
| 2         |
| 7         |
| <u>+5</u> |

|           |
|-----------|
| 1         |
| 4         |
| 4         |
| 3         |
| 2         |
| 7         |
| <u>+6</u> |

|           |
|-----------|
| 3         |
| 4         |
| 5         |
| 6         |
| 5         |
| 4         |
| <u>+9</u> |

|           |
|-----------|
| 8         |
| 9         |
| 2         |
| 8         |
| 7         |
| 1         |
| <u>+7</u> |
2.
 

|            |
|------------|
| 36         |
| 12         |
| 71         |
| 56         |
| <u>+24</u> |

|            |
|------------|
| 24         |
| 35         |
| 32         |
| 45         |
| <u>+58</u> |

|            |
|------------|
| 32         |
| 41         |
| 79         |
| 44         |
| <u>+61</u> |

|            |
|------------|
| 21         |
| 16         |
| 42         |
| 31         |
| <u>+43</u> |
3.
 

|             |
|-------------|
| 214         |
| 457         |
| 233         |
| 429         |
| <u>+295</u> |

|             |
|-------------|
| 456         |
| 442         |
| 164         |
| 333         |
| <u>+377</u> |

|             |
|-------------|
| 335         |
| 149         |
| 252         |
| 390         |
| <u>+646</u> |

|             |
|-------------|
| 463         |
| 257         |
| 135         |
| 874         |
| <u>+780</u> |
4.
 

|              |
|--------------|
| 6353         |
| 1782         |
| 4361         |
| 1534         |
| 2166         |
| <u>+3215</u> |

|              |
|--------------|
| 2432         |
| 3678         |
| 2563         |
| 7377         |
| 4162         |
| <u>+6846</u> |

|              |
|--------------|
| 6075         |
| 5069         |
| 2134         |
| 4630         |
| 2524         |
| <u>+4551</u> |

|              |
|--------------|
| 5198         |
| 3612         |
| 4533         |
| 3181         |
| 1546         |
| <u>+1260</u> |

Review Henry's way of checking addition on page 10. Use it to check your answers to these additions.

5.
 

|            |
|------------|
| 28         |
| 61         |
| 17         |
| 98         |
| 5          |
| <u>+53</u> |

|             |
|-------------|
| 457         |
| 92          |
| 603         |
| 465         |
| 921         |
| <u>+240</u> |

|            |
|------------|
| 4762       |
| 9036       |
| 137        |
| 6463       |
| 4106       |
| <u>+15</u> |

|             |
|-------------|
| 1268        |
| 9           |
| 587         |
| 768         |
| 5930        |
| <u>+372</u> |
6.
 

|            |
|------------|
| 33         |
| 25         |
| 4          |
| 46         |
| <u>+51</u> |

|             |
|-------------|
| 345         |
| 42          |
| 164         |
| 37          |
| <u>+335</u> |

|              |
|--------------|
| 3412         |
| 506          |
| 5514         |
| 354          |
| <u>+1492</u> |

|              |
|--------------|
| 8113         |
| 43           |
| 236          |
| 158          |
| <u>+7137</u> |

## Remembering What You Have Learned

1. In the number 705 there are how many hundreds? How many tens? How many ones?

2. In the number 23,900, are there any tens in tens place? What is the value of the 3 in this number?

3. In which of the following numbers do the 4's have the same value?

42,609,529    4,623,227    524,009,163

4. In the number 50,126, zero is a place-holder. It shows there are no thousands in thousands place. What would the number be if you forgot to use the place-holder?

## Subtracting by the Exact Tens Way



Frank and his father are weighing and loading chickens to be taken to market. They weigh the empty crate first. Then they put 20 chickens in the crate and weigh it again.

Frank writes the weight of the crate when it is empty and the weight when it is full. Here are the weights he wrote for the first three crates.

|                       | CRATE | CRATE | CRATE |
|-----------------------|-------|-------|-------|
|                       | 1     | 2     | 3     |
| Pounds when full      | 86    | 83    | 92    |
| Pounds when empty     | 18    | 25    | 19    |
| Weight of 20 chickens | ?     | ?     | ?     |

1. How can the weight of 20 chickens be found?

When Frank began subtracting, he subtracted in the way shown at the right. His father said, "You can subtract without using your pencil. Just change your numbers so the subtrahend will be an exact number of tens." To show Frank what he meant, his father

$$\begin{array}{r} 86 \\ -18 \\ \hline 68 \end{array}$$

did the subtraction for the first crate like this.

|     |            |       |     |
|-----|------------|-------|-----|
| 86  | minuend    | THINK | 88  |
| -18 | subtrahend |       | -20 |
| 68  | difference |       | 68  |

2. What number did Frank's father add to the subtrahend to get an exact number of tens?

3. What number did he then add to the minuend?

4. Subtract in the usual way and find out if the difference for  $88 - 20$  is the same as for  $86 - 18$ .

5. Use the father's exact tens way to find the weight of the chickens in crate 2. In crate 3.

Use the exact tens way to find the differences.

$$\begin{array}{r} 46 \\ -28 \\ \hline \end{array} \quad \begin{array}{r} 91 \\ -76 \\ \hline \end{array} \quad \begin{array}{r} 35 \\ -17 \\ \hline \end{array} \quad \begin{array}{r} 52 \\ -24 \\ \hline \end{array}$$

$$\begin{array}{r} 63 \\ -35 \\ \hline \end{array} \quad \begin{array}{r} 72 \\ -46 \\ \hline \end{array} \quad \begin{array}{r} 34 \\ -25 \\ \hline \end{array} \quad \begin{array}{r} 36 \\ -28 \\ \hline \end{array}$$

8. Check your answers for row 6 by subtracting in the usual way.



## The Tapping Test in Subtraction



How well you can subtract depends on how well you know the basic subtraction facts.

■ A **subtraction fact** is any subtraction question and its answer.

■ A **basic subtraction fact** is any subtraction fact in which a one-figure number is subtracted from any number from 0 through 18, and the difference is a one-figure number.

1. Which facts below are not basic subtraction facts? Why?

$$\begin{array}{r} 18 \\ -9 \\ \hline 9 \end{array} \quad \begin{array}{r} 7 \\ -2 \\ \hline 5 \end{array} \quad \begin{array}{r} 14 \\ -3 \\ \hline 11 \end{array} \quad \begin{array}{r} 17 \\ -9 \\ \hline 8 \end{array} \quad \begin{array}{r} 15 \\ -6 \\ \hline 9 \end{array} \quad \begin{array}{r} 11 \\ -10 \\ \hline 1 \end{array}$$

2. Use the numbers 15, 12, 3, 9, 5, and 6. Write at least ten basic subtraction facts.

Test yourself on the basic subtraction facts by using the tapping test on these number questions.

### Subtraction Tapping Test

$$\begin{array}{r} 3. \quad 15 \\ -9 \\ \hline \end{array} \quad \begin{array}{r} 12 \\ -6 \\ \hline \end{array} \quad \begin{array}{r} 16 \\ -8 \\ \hline \end{array} \quad \begin{array}{r} 10 \\ -6 \\ \hline \end{array} \quad \begin{array}{r} 8 \\ -5 \\ \hline \end{array} \quad \begin{array}{r} 13 \\ -9 \\ \hline \end{array}$$

$$\begin{array}{r} 4. \quad 16 \\ -7 \\ \hline \end{array} \quad \begin{array}{r} 14 \\ -9 \\ \hline \end{array} \quad \begin{array}{r} 9 \\ -6 \\ \hline \end{array} \quad \begin{array}{r} 12 \\ -3 \\ \hline \end{array} \quad \begin{array}{r} 10 \\ -2 \\ \hline \end{array} \quad \begin{array}{r} 17 \\ -8 \\ \hline \end{array}$$

$$\begin{array}{r} 5. \quad 14 \\ -8 \\ \hline \end{array} \quad \begin{array}{r} 8 \\ -3 \\ \hline \end{array} \quad \begin{array}{r} 17 \\ -9 \\ \hline \end{array} \quad \begin{array}{r} 7 \\ -5 \\ \hline \end{array} \quad \begin{array}{r} 15 \\ -7 \\ \hline \end{array} \quad \begin{array}{r} 13 \\ -8 \\ \hline \end{array}$$

$$\begin{array}{r} 6. \quad 12 \\ -9 \\ \hline \end{array} \quad \begin{array}{r} 10 \\ -4 \\ \hline \end{array} \quad \begin{array}{r} 18 \\ -9 \\ \hline \end{array} \quad \begin{array}{r} 12 \\ -7 \\ \hline \end{array} \quad \begin{array}{r} 16 \\ -9 \\ \hline \end{array} \quad \begin{array}{r} 13 \\ -7 \\ \hline \end{array}$$

$$\begin{array}{r} 7. \quad 15 \\ -6 \\ \hline \end{array} \quad \begin{array}{r} 8 \\ -2 \\ \hline \end{array} \quad \begin{array}{r} 14 \\ -6 \\ \hline \end{array} \quad \begin{array}{r} 15 \\ -8 \\ \hline \end{array} \quad \begin{array}{r} 12 \\ -5 \\ \hline \end{array} \quad \begin{array}{r} 9 \\ -7 \\ \hline \end{array}$$

$$\begin{array}{r} 8. \quad 14 \\ -5 \\ \hline \end{array} \quad \begin{array}{r} 7 \\ -2 \\ \hline \end{array} \quad \begin{array}{r} 17 \\ -8 \\ \hline \end{array} \quad \begin{array}{r} 14 \\ -7 \\ \hline \end{array} \quad \begin{array}{r} 11 \\ -9 \\ \hline \end{array} \quad \begin{array}{r} 13 \\ -4 \\ \hline \end{array}$$

If your saying of the differences and your tapping were regular and reasonably fast, you know the subtraction facts.

If your tapping was not regular or if it was slow, you do not know the facts well enough. Do the test again to be sure of your answers and your tapping rate.

9. For each subtraction below write the basic subtraction fact that you think when you subtract in ones place.

$$\begin{array}{r} 25 \\ -9 \\ \hline \end{array} \quad \begin{array}{r} 36 \\ -8 \\ \hline \end{array} \quad \begin{array}{r} 57 \\ -39 \\ \hline \end{array} \quad \begin{array}{r} 34 \\ -15 \\ \hline \end{array} \quad \begin{array}{r} 69 \\ -34 \\ \hline \end{array} \quad \begin{array}{r} 83 \\ -65 \\ \hline \end{array}$$

If you do not know the basic subtraction facts well, study the facts on page 321. Study the subtraction facts in ways similar to those described for studying basic addition facts on page 9.

## Special Subtraction Practice

|   |    |    |    |    |    |    |    |    |   |    |
|---|----|----|----|----|----|----|----|----|---|----|
| A | 10 | 14 | 16 | 13 | 11 | 17 | 18 | 12 | 9 | 15 |
| 0 | 0  | 4  | 6  | 2  | 8  | 3  | 9  | 7  | 1 | 5  |
| 1 | 1  | 5  | 7  | 9  | 4  | 6  | 8  | 3  | 2 |    |
| 2 | 3  | 6  | 9  | 2  | 8  | 4  | 7  | 5  |   |    |
| 3 | 5  | 4  | 7  | 9  | 3  | 8  | 6  |    |   |    |
| 4 | 6  | 8  | 5  | 4  | 9  | 7  |    |    |   |    |
| 5 | 8  | 6  | 9  | 5  | 7  |    |    |    |   |    |
| 6 | 7  | 9  | 6  | 8  |    |    |    |    |   |    |
| 7 | 8  | 7  | 9  |    |    |    |    |    |   |    |
| 8 | 9  | 8  |    |    |    |    |    |    |   |    |
| 9 | 9  |    |    |    |    |    |    |    |   |    |



Here are some special exercises to help you study subtraction facts.

1. Subtract each number in column A from every red number in the top row. Having someone point for you while you subtract may help you.

2. Subtract each number in column A from every number in the row at the right of it.

3. After you subtract zero from each number to the right of it,

make a rule about subtracting zero from a number.

4. Study these subtractions. Then cover the differences. See if you can write them correctly on folded paper.

|        |        |        |        |
|--------|--------|--------|--------|
| 6000   | 9007   | 5684   | 4200   |
| - 1546 | - 32   | - 4000 | - 2400 |
| 4454   | 8975   | 1684   | 1800   |
| 6923   | 6400   | 2961   | 3006   |
| - 5019 | - 2040 | - 2661 | - 1111 |
| 1904   | 4360   | 300    | 1895   |



## Checking Subtraction



|                                                           |                                                                                                                                                     |                                                        |
|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| $\begin{array}{r} 75¢ \\ - 54¢ \\ \hline 21¢ \end{array}$ | <div style="display: flex; flex-direction: column; align-items: flex-start;"> <div>minuend</div> <div>subtrahend</div> <div>difference</div> </div> | $\begin{array}{r} 54 \\ + 21 \\ \hline 75 \end{array}$ |
|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|

or

|                                                              |   |     |
|--------------------------------------------------------------|---|-----|
| $\begin{array}{r} \$ .75 \\ - .54 \\ \hline .21 \end{array}$ | } | ADD |
| .75                                                          |   |     |

Jim bought a notebook costing 54¢. He gave the clerk 75¢ and received 21¢ in change. He wanted to be sure that he got the right change.

His sister said, "You can always check a subtraction example by adding the difference and the subtrahend. The answer should be the amount with which you began in your subtraction."

1. What name is given to the number written at the top in a subtraction example?

2. The illustration at the top of the page shows how Jim checked the amount of change he received. Did he get the right amount?

3. Write five subtraction examples. Find the differences. For each example add the difference and the subtrahend. Is the sum of the subtrahend and the difference always equal to the minuend?

4. Place a folded paper below the answers to these examples. Check by adding. Are all the answers correct?

|            |            |            |            |            |            |
|------------|------------|------------|------------|------------|------------|
| 64         | 91         | 83         | 43         | 29         | 61         |
| <u>-27</u> | <u>-20</u> | <u>-49</u> | <u>-28</u> | <u>-16</u> | <u>-35</u> |
| 37         | 71         | 44         | 15         | 13         | 36         |

5. Copy the examples. Find the differences. Check by adding.

|            |            |            |            |            |            |
|------------|------------|------------|------------|------------|------------|
| 36         | 97         | 76         | 85         | 91         | 48         |
| <u>-21</u> | <u>-83</u> | <u>-32</u> | <u>-42</u> | <u>-31</u> | <u>-30</u> |

In rows 6-8 you may need to borrow in ones place, in tens place, or in both as you subtract. Find the differences. Check by adding.

6. 

|             |
|-------------|
| 783         |
| <u>-235</u> |

|             |
|-------------|
| 695         |
| <u>-449</u> |

|             |
|-------------|
| 834         |
| <u>-575</u> |

|             |
|-------------|
| 955         |
| <u>-382</u> |

7. 

|             |
|-------------|
| 857         |
| <u>-643</u> |

|             |
|-------------|
| 946         |
| <u>-215</u> |

|             |
|-------------|
| 312         |
| <u>-191</u> |

|             |
|-------------|
| 594         |
| <u>-475</u> |

8. 

|               |
|---------------|
| \$68.75       |
| <u>-14.32</u> |

|               |
|---------------|
| \$24.68       |
| <u>-12.83</u> |

|               |
|---------------|
| \$28.75       |
| <u>-19.69</u> |

## Borrowing When There Is a Zero in Tens Place

1. To fill the 400-gallon tank of an airplane, 176 gallons of gasoline were needed. To find how many gallons were in the tank before the refueling began, Bill said that you had to subtract. Is that the right way to find out?

2. When Ann subtracted 176 from 400, she said, "There are no tens from which to borrow. I'll change one of the hundreds to 10 tens. Then I can change one of the tens to ones." Is her way of subtracting correct?

$$\begin{array}{r} \text{ANN} \\ 400 \\ -176 \\ \hline 224 \end{array}$$

3. Bill said that 40 tens equal 400. If one of them were changed to 10 ones, 39 tens would remain. This is a shorter way. Write a subtraction to show that Bill's thinking was correct.

4. Copy. Find the differences. Show each step as you borrow.

$$\begin{array}{r} 603 \\ -129 \\ \hline \end{array} \quad \begin{array}{r} 306 \\ -125 \\ \hline \end{array} \quad \begin{array}{r} 702 \\ -184 \\ \hline \end{array} \quad \begin{array}{r} 503 \\ -485 \\ \hline \end{array} \quad \begin{array}{r} 602 \\ -495 \\ \hline \end{array}$$

5. Copy. Find the differences. Use the shorter way to borrow.

$$\begin{array}{r} 600 \\ -243 \\ \hline \end{array} \quad \begin{array}{r} 805 \\ -296 \\ \hline \end{array} \quad \begin{array}{r} 605 \\ -198 \\ \hline \end{array} \quad \begin{array}{r} 200 \\ -77 \\ \hline \end{array} \quad \begin{array}{r} 1000 \\ -843 \\ \hline \end{array}$$

When you see "No Pencils, Please!" you are to do the work in your mind and say the answer.

### No Pencils, Please!

1. The number 775 is equal to how many tens and how many ones?

2. In the subtraction  $40 - 17$ , you borrow one of the 4 tens. What is done with the 1 ten?

3. How many ones equal 850? How many tens?

4. Sixty-four tens are equal to what number?

5. Joan did the addition below. Then she checked the addition. Explain her check. In what way is her check different from her first addition? Is there any way in which the check is like the first addition?

|      | CHECK |
|------|-------|
| JOAN | 345   |
| 345  | 26    |
| 26   | +597  |
| +597 | 18    |
| 968  | 15    |
|      | 8     |
|      | 968   |

6. Give the value of each partial sum in the check Joan used.



### Different Kinds of Questions in Subtraction Problems

You may subtract to find the answer to several kinds of number questions and problems. See how many different kinds of questions you can find in these problems.

1. The goal for the Red Cross fund for one city was \$19,850. On the sixth day of the drive, \$13,209 had been raised. How much more money had to be raised before the goal would be reached?

2. The heaviest player on a certain football team weighs 213 pounds. The lightest player weighs 138 pounds. What is the difference in weight between the two players?

3. A merchant placed 372 neckties on sale at one-half price. At the end of the first day he had only 113 left. How many had he sold?

4. A boy spent \$64 of the \$90 he had for a bicycle. How much did he have left after he paid for the bicycle?

5. There were 516 pupils in the old North Side School and 428 pupils in the new North Side School. How many more pupils were there in the old school than in the new one?

6. Write a subtraction problem

in which you use, "How many more are needed?" Write another in which you use, "How many are left?" Write another in which you use, "What is the difference?"

Solve problems 1 through 5 above. Then answer the questions in the following. Be sure the question is a subtraction question if you subtract.

7. Tom needs 1250 stamps to fill his book with savings stamps. He now has 850 stamps in his book. How many more stamps does he need to fill his book?

8. Sharon read three storybooks last month. One book had 298 pages, another had 185 pages, and the third had 356 pages. How many pages had she read when she finished?

9. In a recent year Colorado produced 119,000 ounces of gold worth \$4,173,000. The previous year that state produced 125,000 ounces worth \$4,361,000. In the year of greater production, Colorado produced how many more ounces of gold than in the preceding year? The smaller amount of gold was worth how much less than the larger amount?

## Another Subtraction Check

| SUBTRACTION |     | CHECK |
|-------------|-----|-------|
|             | 163 | 163   |
| subtrahend  | -97 | -66   |
| difference  | 66  | 97    |

1. Study the subtraction check at the top of the page. Explain what was done to check the subtraction. How does this check differ from the check given on page 17?

2. Use a dot drawing. Show that in the subtraction  $8 - 6 = 2$ , the sum of the subtrahend and difference equals the minuend.

3. Use a dot drawing. Show that in the subtraction  $7 - 4 = 3$ , the difference taken from the minuend equals the subtrahend.

► Copy. Find the differences. Check by the method shown on this page.

|    |             |             |             |             |
|----|-------------|-------------|-------------|-------------|
| 4. | 155<br>-89  | 216<br>-142 | 395<br>-168 | 400<br>-218 |
| 5. | 651<br>-84  | 756<br>-281 | 916<br>-855 | 842<br>-386 |
| 6. | 600<br>-6   | 804<br>-9   | 590<br>-5   | 699<br>-9   |
| 7. | 857<br>-652 | 419<br>-409 | 487<br>-198 | 503<br>-59  |
| 8. | 519<br>-105 | 587<br>-189 | 872<br>-8   | 962<br>-62  |

► Copy. Find the differences. Check by the method shown here or by the one given on page 17.

|     |               |               |               |
|-----|---------------|---------------|---------------|
| 9.  | 7180<br>-6024 | 9081<br>-3465 | 8174<br>-3653 |
| 10. | 4532<br>-2125 | 9114<br>-2008 | 8003<br>-1247 |
| 11. | 7000<br>-1304 | 4000<br>-2991 | 8794<br>-2093 |
| 12. | 6035<br>-3066 | 9004<br>-3009 | 6173<br>-3019 |

## Keeping in Practice

► Write sums on folded paper. Check by adding up.

|    |                                   |                                               |                                               |                                               |
|----|-----------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| 1. | 8<br>5<br>9<br>2<br>0<br>+1       | 5274<br>5092<br>4128<br>5287<br>2635<br>+9528 | 428<br>193<br>538<br>837<br>139<br>+528       | 5401<br>2487<br>3982<br>1289<br>7834<br>+4238 |
| 2. | 28<br>52<br>73<br>89<br>56<br>+78 | 3752<br>9604<br>5534<br>7329<br>1873<br>+7429 | 1489<br>5612<br>7892<br>4286<br>9329<br>+1895 | 1794<br>2739<br>7928<br>3897<br>1859<br>+1875 |



## Taking Stock — Test 1



Write the answers on folded paper. Your teacher will tell you when to start and when to stop.

### PART I ADDITION

$$\begin{array}{r} 1. \quad 39 \quad 46 \quad 32 \quad 794 \\ \quad +8 \quad +19 \quad +68 \quad +309 \end{array}$$

$$\begin{array}{r} 2. \quad 908 \quad 897 \quad 5295 \quad 1738 \\ \quad +486 \quad +709 \quad +136 \quad +9264 \end{array}$$

$$\begin{array}{r} 3. \quad 28 \quad 47 \quad 120 \quad \$46.38 \\ \quad 72 \quad 39 \quad 389 \quad .07 \\ \quad 60 \quad 86 \quad 16 \quad 1.58 \\ \quad +59 \quad +52 \quad +412 \quad +9.05 \end{array}$$

$$\begin{array}{r} 4. \quad 725 \quad 321 \quad 428 \quad 9024 \\ \quad 327 \quad 590 \quad 963 \quad 146 \\ \quad 182 \quad 42 \quad 497 \quad 4520 \\ \quad +571 \quad +80 \quad +854 \quad +8789 \end{array}$$

$$\begin{array}{r} 5. \quad 5274 \quad 3827 \quad \$96.55 \\ \quad 5092 \quad 9003 \quad 38.20 \\ \quad 4008 \quad 4962 \quad 5.06 \\ \quad +6591 \quad +8304 \quad +18.60 \end{array}$$

### PART II SUBTRACTION

$$\begin{array}{r} 6. \quad 17 \quad 36 \quad 40 \quad 38 \\ \quad -9 \quad -18 \quad -17 \quad -17 \end{array}$$

$$\begin{array}{r} 7. \quad 64 \quad 390 \quad 456 \quad 906 \\ \quad -59 \quad -185 \quad -381 \quad -179 \end{array}$$

$$\begin{array}{r} 8. \quad 70 \quad 64 \quad 152 \quad 831 \\ \quad -31 \quad -18 \quad -93 \quad -142 \end{array}$$

$$\begin{array}{r} 9. \quad 105 \quad 765 \quad 402 \quad 500 \\ \quad -56 \quad -459 \quad -193 \quad -32 \end{array}$$

$$\begin{array}{r} 10. \quad \$4.00 \quad \$6.51 \quad \$8.19 \\ \quad \quad - .95 \quad - 2.05 \quad - 1.29 \end{array}$$

Check your answers as someone reads the correct ones. Write your score at the top of your paper.

In each unit of this book you will find a test called "Taking Stock." It will be easy to compare your scores if you make a record sheet.

Use an unlined sheet of paper the size of your arithmetic notebook page. Draw a rectangle  $9\frac{1}{2}$  inches high and 6 inches wide.

Mark off in half inches the top and the bottom lines of your rectangle. From each mark at the top draw a line to the opposite mark at the bottom of the rectangle. Your rectangle will then be marked off into twelve one-half inch columns.

Next mark off in quarter inches the right- and left-hand sides of your rectangle. Draw a line from each mark at the left to the opposite mark at the right.

Number these lines from 1 to 38. Write the number of each test across the bottom.

In the column for Test 1, color or shade as many spaces as equal your score for the first "Taking Stock" test.

## Reading and Writing Roman Numbers

Janet was looking at the cornerstone of the school building.

"I know our school was built in 1952," she said, "and I know that in Roman numbers M is 1000, C is 100, L is 50, and II is 2. But MCMLII does not add up to 1952."

What had Janet forgotten about Roman numbers? Study these rules.

**RULE I.** Remember the meaning in our numbers of the seven letters used in writing Roman numbers.

|     |      |
|-----|------|
| I = | 1    |
| V = | 5    |
| X = | 10   |
| L = | 50   |
| C = | 100  |
| D = | 500  |
| M = | 1000 |

**RULE II.** When a letter is repeated, its value is repeated.

$$\text{III} = 1 + 1 + 1 = 3.$$

$$\text{XX} = 20 \quad \text{CCC} = 300 \quad \text{MM} = 2000$$

**RULE III.** When a letter of lesser value follows a letter of greater value, the value of the number is the sum of the values of the two letters.  $\text{MD} = 1000 + 500 = 1500$ .

$$\text{DC} = 600 \quad \text{VI} = 6 \quad \text{XV} = 15 \quad \text{CL} = 150$$

**RULE IV.** When a letter of lesser value comes before a letter of greater value, the value of the number is the difference in the values of the two letters.

$$\text{CM} = 1000 - 100 = 900.$$

$$\text{IX} = 9 \quad \text{XC} = 90 \quad \text{CD} = 400$$



1. What letters in the number MCMLII follow Rule IV? Rule III?

2. Write the present year as a Roman number.

3. Write these numbers with Roman numerals.

26    58    39    178    2005

4. Read these Roman numbers.  
XIII    CCV    XXVII    XLI    XXXV  
MCL    XIV    XCVIII    LXXV    MCDXCI

5. Write these numbers with Roman numerals.

From 36 to 42    From 98 to 103

From 476 to 482    From 1933 to 1937

6. Here are some famous dates in history. Write them using Roman numerals.

1776    1492    1914

1918    1941    1812



## Using Roman Numerals



1. A cartoon motion picture bears the statement, "Copyright MCMXLIX." Is this picture more or less than 10 years old?

2. The cornerstone of an old church shows that the church was erected in MDCXCII. In what year was the church built?

3. The copyright date in a book is MCMXXXV. Is the book more than 20 years old?

4. John said he took his material for his report from volume XVIII of the encyclopedia. What is the number of the volume he used?

5. Write with Roman numerals the date that would appear on a motion picture produced in 1957. In 1939. In 1940. In 1956.

6. Six old buildings in a certain city had these dates on their cornerstones: 1809; 1813; 1820; 1836; 1851; 1860. Write each date with Roman numerals.

7. Roman numerals are often used to mark the hours on a clock face. On the clock pictured above, one of the numbers is written in a different way from the way you

have just been studying. Which number is it?

8. In all the Roman numbers you have written and read, you have not seen the numeral V repeated. What Roman numeral is used to show V and V? Why are L and D never repeated?

9. If a numeral is repeated too often, the Roman number is hard to read. Which is read more quickly, IIII or IV? Can you give a reason why the Romans used Rule IV in writing some of their numbers instead of always using Rule III?

10. There are 32 books in Tom's set of encyclopedias. The books are numbered with Roman numbers. Use Roman numerals, and write the numbers of the last half of the set of encyclopedias.

11. Explain these statements:

- Numerals used in writing Roman numbers have no place value as the numerals in our number system have.
- Roman numbers do not have a zero, or place-holder.

## No Pencils, Please!



1. Is a seven-place number a million or a billion number?

2. How many commas are used in writing the number ten million?

3. What rule is used in placing the commas in large numbers?

4. Name the places that are held by zeros in these numbers.

7230      123,004      1,360,000,999

5. How much is twenty-six, seventeen, and thirty-one?

6. How much is fourteen, thirty-two, and forty-one?

7. Find the differences in these examples by making the subtrahend an exact number of tens.

|            |            |            |            |            |
|------------|------------|------------|------------|------------|
| 54         | 64         | 81         | 42         | 35         |
| <u>-17</u> | <u>-29</u> | <u>-38</u> | <u>-26</u> | <u>-19</u> |

8. How many letters are needed to write the number 1500 with Roman numerals?

For the examples in row 9, find the sums in both columns at the

same time. You will find help on page 6 if you do not remember this way of adding.

|    |            |            |            |            |            |
|----|------------|------------|------------|------------|------------|
| 9. | 53         | 16         | 34         | 45         | 24         |
|    | 31         | 42         | 56         | 27         | 35         |
|    | <u>+15</u> | <u>+31</u> | <u>+23</u> | <u>+45</u> | <u>+59</u> |

### Mixed Practice

► Use folded paper. Write the answers.

|    |             |             |             |            |
|----|-------------|-------------|-------------|------------|
| 1. | 469         | 318         | 804         | 96         |
|    | 384         | 485         | 29          | 154        |
|    | 205         | 183         | 314         | 723        |
|    | 60          | 760         | 867         | 844        |
|    | <u>+153</u> | <u>+409</u> | <u>+102</u> | <u>+12</u> |

|    |              |                |                |
|----|--------------|----------------|----------------|
| 2. | \$5.19       | \$7.50         | \$123.50       |
|    | .26          | 22.85          | 14.25          |
|    | .84          | 1.63           | 515.98         |
|    | 2.35         | 42.00          | 742.75         |
|    | <u>+8.16</u> | <u>+184.60</u> | <u>+195.34</u> |

|    |             |            |             |             |
|----|-------------|------------|-------------|-------------|
| 3. | 906         | 515        | 700         | 211         |
|    | <u>-128</u> | <u>-84</u> | <u>-648</u> | <u>-142</u> |

|    |               |              |             |
|----|---------------|--------------|-------------|
| 4. | \$60.10       | \$3.00       | \$140.00    |
|    | <u>-45.56</u> | <u>-1.17</u> | <u>-.98</u> |



## Rounding Numbers

1. A newspaper story stated that only one tenth of the 3 million square miles in the United States is suitable for raising crops. Did using the **round** number 3,000,000 rather than the exact number 3,022,387 change the meaning of the statement?

2. What part of the number was dropped when the number was rounded? Why was it dropped?

3. The exact areas of the various continents in square miles are given below. Round each number to the nearest million.

|                    |            |
|--------------------|------------|
| Africa.....        | 11,622,619 |
| Asia.....          | 17,206,418 |
| Australia.....     | 2,948,366  |
| North America..... | 8,589,257  |
| South America..... | 7,570,015  |
| Europe.....        | 3,872,561  |

4. The 1950 population of six of the largest cities in Ohio is given here in order of size.

|                 |         |
|-----------------|---------|
| Cleveland.....  | 914,808 |
| Cincinnati..... | 503,998 |
| Columbus.....   | 375,901 |
| Toledo.....     | 303,616 |
| Akron.....      | 274,605 |
| Dayton.....     | 243,872 |

If each population figure were rounded to the nearest thousand,

would the order in which the cities are ranked be changed? Read each figure rounded to the nearest thousand.

5. In a recent year, the number of radio sets manufactured was 3,067,644 home sets, 1,333,518 portables, 4,124,460 automobile radios, and 1,874,908 clock radios. Jerry said there were about 10,000,000 radios manufactured that year. Check Jerry's statement by rounding each number to the nearest million before adding.

6. Round these amounts to the nearest hundred.

5682   \$1526.76   20,285   446

Write with figures ready for adding. Add. Round each sum to the nearest dollar.

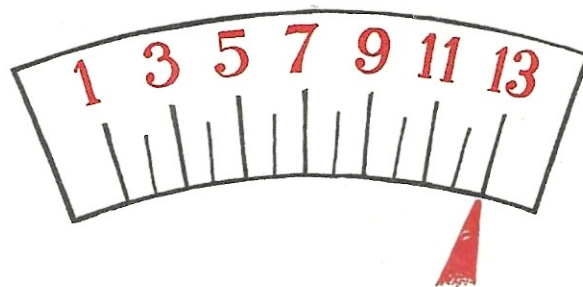
7. Fifty cents, nine cents, and thirty-seven cents.

8. One dollar and four cents, five dollars, eighty cents, and three cents.

9. Two dollars, one dollar and ten cents, fourteen dollars and seventy-five cents.

10. Four cents, twenty dollars and sixty cents, ninety cents, and two cents.

### How Well Have You Learned?



Doing these examples will help you find out how well you have learned the work in this unit.

Write the answers. Then check your answers with the right ones. Your score will show you how well you understand what you have studied.

1. Write the number 123 billion with figures. Place the commas properly in the number you write.

2. What period name is never used in reading large numbers?

3. How many figures are needed to write 8 billion with figures? Which of these figures are place-holders?

4. Give a rule for adding zero and another number.

5. Give a rule for adding 1 and another number.

6. If you had no pencil or paper, what would be a good way to add such an example as this one?

$$42 + 18 + 21 + 12 = \square$$

7. Use the subtraction  $4 - 1 = 3$ .

Show that the minuend minus the difference is equal to the subtrahend.

8. Begin at 58 and count by 4's. What is the first number you say in the eighties?

9. Write in words how the Roman number CXLV is read.

10. What is 1852 rounded to the nearest hundred?

11. Subtract 17 from 59. Use the way in which you make the subtrahend an exact number of tens.

12. Mrs. Jones had only a \$20-dollar bill with her. She bought \$25.87 worth of groceries. She gave the grocer the \$20-dollar bill and told him to charge the difference. How much was this?

13. In a certain year the world pear crop was 157,097,000 bu. The previous year the crop was 166,887,000 bu. Round each number to the nearest million and find how much the crop decreased from the preceding year.



## Help Yourself to Improve

Doing these exercises will help you to remember the material that is important in Unit One. The numbers given in parentheses refer to pages where you will find help.

1. How many figures, or digits, do we use in writing our numbers? (1)

2. In 1,524,790,386, what is the name of the place in which the 1 is written? In which the 4 is written? In which the 0 is written? (2, 3)

3. In the number 245,138,697,000 what is the name of the period in which the figures 2, 4, and 5 are written? In which 1, 3, and 8 are written? (2)

4. In the number 9,000,900 what is the value of the first 9? What is the value of the second 9? (4)

5. Add both columns at the same time. Write the sums only. (6)

|            |            |            |            |            |            |
|------------|------------|------------|------------|------------|------------|
| 43         | 51         | 36         | 25         | 32         | 14         |
| 24         | 15         | 42         | 53         | 35         | 23         |
| <u>+31</u> | <u>+23</u> | <u>+12</u> | <u>+46</u> | <u>+62</u> | <u>+84</u> |

6. If you find you cannot add quickly and regularly, do the tapping tests on page 8.

7. Copy ready for adding. Find the sums. Check in two ways. (11, 13)

$$6389 + 527 + 1389 + 42 + 723 = \square$$

8. Copy ready for subtracting. Find the differences. Check in two ways. (17, 20)

$$5394 - 1064 = \square$$

9. Give the rules that you use to read each of these Roman numbers. XXX XL CL

Write the numbers with Arabic numerals. (22, 23)

10. Round the first number to the nearest 10. Round the next number to the nearest hundred. Round the last number to the nearest million. (25)

$$37 \quad 5648 \quad 42,484,816$$

11. In subtracting 18 from 63, use the method of making the subtrahend an exact number of tens. (14)

12. Count by 7's from 22 to the first 50 number. Write this number. (12)

13. Sue had \$1.75 in her savings bank. She added twenty-five cents that her mother gave her and a dollar that she got from her father. How much did she then have in her bank? (10)

14. Bill had \$12.65 in his bank. He took out ninety-five cents. How much was left in his bank? (17)

## Show That You Know



If you understand the work of Unit One, you should be able to work correctly the problems that follow.

Below are the approximate air distances in miles between certain cities.

|                              |      |
|------------------------------|------|
| Los Angeles to New York..... | 2625 |
| New Orleans to Chicago.....  | 857  |
| New York to Boston .....     | 184  |
| London to Athens.....        | 1721 |
| New York to Washington.....  | 226  |
| New York to Chicago.....     | 725  |

1. How much farther is it by air from Los Angeles to New York than from London to Athens?

2. Find the air distance from Los Angeles to Boston by way of New York.

3. Find the air distance from New Orleans to New York by way of Chicago.

4. Which distance given in the table would be about 3000 miles if rounded to the nearest thousand? Round this distance to the nearest hundred instead of the nearest thousand. Which of these rounded numbers would you use if you were

planning an air trip over this route? Why?

5. Mr. Green's speedometer read 17,002 miles when he left for a trip. It read 20,106 miles when he returned. How many miles did he travel on the trip?

6. Mr. Green's speedometer read 20,106 miles when the speedometer on Mr. Hill's car read 43,880 miles. How many more miles had Mr. Hill driven his car?

7. Mr. Smith bought a plane ticket costing \$80.60. In addition to this he paid \$8.06 tax and \$1.50 for transportation from his hotel to the airport. What was the total cost?

8. Mr. Kellogg usually earned \$90 a week. Last week he earned only \$79.95. How much less than usual did he earn last week?

9. Mr. Foster bought a new automobile costing \$2750.00. The dealer allowed \$1025.00 trade-in for Mr. Foster's old car. Mr. Foster paid the difference in cash. How much was his cash payment?

10. Tom paid \$15 down on a bicycle, and had \$25.75 left to pay. What did the bicycle cost?





### A Different Way to Multiply

Ted went to the lumberyard on an errand. On the wall of a shed he saw the drawing shown above.

"What is that?" Ted asked.

"That is where I multiplied 47 and 35," answered an old man who worked there. "That is the way I learned to multiply when I was a boy."

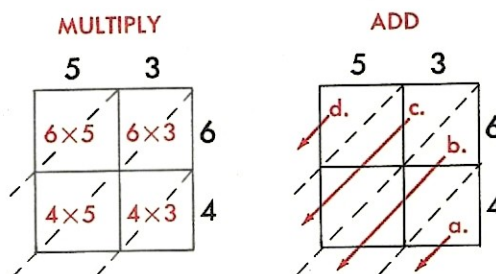
1. Study the man's multiplication. Where did he write the 47 and the 35 that he multiplied?

2. Each figure above the square has been multiplied by each figure at the right side of the square. Each product is written in the small square to the left of one figure and below the other figure. In the drawing above, find the product of  $3 \times 7$ . Of  $3 \times 4$ . Of  $5 \times 7$ . Of  $5 \times 4$ .

3. Start at the bottom right-hand corner. Add the figures in each of the four slanting rows between dotted lines. In the drawing above, these sums are in color. What was

added to get 5? To get 4? To get 6? The answer is 1645.

4. Draw a large square and divide it into four smaller squares. Draw dotted lines across each square. Use the numbers 53 and 64 to multiply. Write the products in the boxes as shown in the picture below. Add as shown, beginning with a. Is your answer 3392?



5. Multiply the numbers 62 and 64, using another drawing. When you wrote the products, where did you have an empty space? Is your answer 3968?

6. Do the multiplications again in the usual way. Which way is easier?

**TED**

**BOB**

|             |                 |             |
|-------------|-----------------|-------------|
| 36          | multiplicand    | 19          |
| $\times 19$ | multiplier      | $\times 36$ |
| 324         | partial product | 114         |
| 36          | partial product | 57          |
| 684         | product         | 684         |

### Ways of Checking Products

Ted's class was studying multiplication. Ted showed the different way of multiplying that he had learned.

Kay asked, "Does it make any difference which number you write at the top of the square and which one you write at the right?"

Ted tested this. His work is shown above.

1. Check Ted's answers by multiplying in the usual way.

Do the examples below using Ted's way of multiplying. Check the answers as he did.

2.  $\begin{array}{r} 23 \\ \times 25 \\ \hline \end{array}$      $\begin{array}{r} 37 \\ \times 18 \\ \hline \end{array}$      $\begin{array}{r} 41 \\ \times 23 \\ \hline \end{array}$      $\begin{array}{r} 59 \\ \times 21 \\ \hline \end{array}$

3.  $\begin{array}{r} 34 \\ \times 13 \\ \hline \end{array}$      $\begin{array}{r} 81 \\ \times 21 \\ \hline \end{array}$      $\begin{array}{r} 27 \\ \times 62 \\ \hline \end{array}$      $\begin{array}{r} 21 \\ \times 19 \\ \hline \end{array}$

Bob said, "What Ted really did was to change the places of the multiplier and the multiplicand. You can check regular multiplication in the same way."

4. Study Bob's work above. Was he right? How do you know?

► Do the examples below in the usual way. Check as Bob did.

5.  $\begin{array}{r} 48 \\ \times 15 \\ \hline \end{array}$      $\begin{array}{r} 56 \\ \times 23 \\ \hline \end{array}$      $\begin{array}{r} 28 \\ \times 16 \\ \hline \end{array}$      $\begin{array}{r} 39 \\ \times 14 \\ \hline \end{array}$

6.  $\begin{array}{r} 51 \\ \times 32 \\ \hline \end{array}$      $\begin{array}{r} 27 \\ \times 19 \\ \hline \end{array}$      $\begin{array}{r} 63 \\ \times 28 \\ \hline \end{array}$      $\begin{array}{r} 54 \\ \times 17 \\ \hline \end{array}$

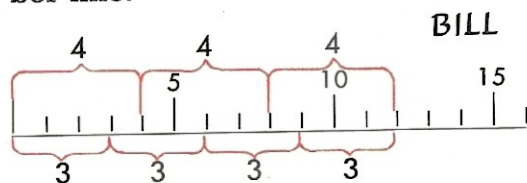
7.  $\begin{array}{r} 72 \\ \times 31 \\ \hline \end{array}$      $\begin{array}{r} 49 \\ \times 25 \\ \hline \end{array}$      $\begin{array}{r} 35 \\ \times 12 \\ \hline \end{array}$      $\begin{array}{r} 32 \\ \times 26 \\ \hline \end{array}$

8.  $\begin{array}{r} 35 \\ \times 22 \\ \hline \end{array}$      $\begin{array}{r} 49 \\ \times 17 \\ \hline \end{array}$      $\begin{array}{r} 32 \\ \times 28 \\ \hline \end{array}$      $\begin{array}{r} 17 \\ \times 17 \\ \hline \end{array}$

Bill wanted to be certain that the product would be the same when he changed the places of the multiplier and the multiplicand. He drew a number line to show that the product was the same if the multiplier and the multiplicand changed places.



9. Write the two multiplication facts that Bill showed on his number line.



Alice multiplied  $13 \times 25$ . She checked the product in a different way. She said, "The multiplier 13 equals 1 ten and 3 ones. Multiply 25 by 10. Then multiply 25 by 3. Add the two products."

ALICE

$$\begin{array}{r} 25 \\ \times 13 \\ \hline 75 \\ 25 \\ \hline 325 \end{array}$$

CHECK

$$\begin{array}{r} 25 \\ \times 10 \\ \hline 250 \end{array} \quad \begin{array}{r} 25 \\ \times 3 \\ \hline 75 \end{array} \quad \begin{array}{r} 250 \\ + 75 \\ \hline 325 \end{array}$$

10. Did Alice's way of checking give the same product?

11. Explain why it is easy to multiply a number by 10.

► Find the products. Check by using either Bob's or Alice's way.

$$\begin{array}{r} 12. \quad 23 \\ \times 14 \end{array} \quad \begin{array}{r} 44 \\ \times 15 \end{array} \quad \begin{array}{r} 19 \\ \times 12 \end{array} \quad \begin{array}{r} 56 \\ \times 31 \end{array}$$

$$\begin{array}{r} 13. \quad 69 \\ \times 14 \end{array} \quad \begin{array}{r} 87 \\ \times 56 \end{array} \quad \begin{array}{r} 96 \\ \times 28 \end{array} \quad \begin{array}{r} 38 \\ \times 79 \end{array}$$

► Multiply. Check by interchanging the multiplier and the multiplicand.

$$\begin{array}{r} 14. \quad 35 \\ \times 62 \end{array} \quad \begin{array}{r} 43 \\ \times 27 \end{array} \quad \begin{array}{r} 91 \\ \times 45 \end{array} \quad \begin{array}{r} 54 \\ \times 86 \end{array}$$

$$\begin{array}{r} 15. \quad 37 \\ \times 78 \end{array} \quad \begin{array}{r} 47 \\ \times 39 \end{array} \quad \begin{array}{r} 65 \\ \times 58 \end{array} \quad \begin{array}{r} 52 \\ \times 76 \end{array}$$

$$\begin{array}{r} 16. \quad 48 \\ \times 33 \end{array} \quad \begin{array}{r} 85 \\ \times 64 \end{array} \quad \begin{array}{r} 58 \\ \times 76 \end{array} \quad \begin{array}{r} 79 \\ \times 42 \end{array}$$

$$\begin{array}{r} 17. \quad 56 \\ \times 98 \end{array} \quad \begin{array}{r} 74 \\ \times 85 \end{array} \quad \begin{array}{r} 98 \\ \times 72 \end{array} \quad \begin{array}{r} 95 \\ \times 63 \end{array}$$

18. Mr. James finds that he can travel 15 miles on a gallon of gasoline. How far can he travel if he has 16 gallons of gasoline in the tank of his car?

19. There are 24 cans of tomatoes in a case. How many cans will there be in 48 cases?

20. At an average speed of 45 miles per hour, how far can Mr. Wilson drive in 15 hours?

21. The teacher said there were about 32 pupils per room in Jerry's school. Jerry counted 21 rooms in the school. About how many pupils attend Jerry's school?

22. Mr. Green was paid for 27 bushels of wheat. If 60 lb. makes one bushel of wheat, for how many pounds was Mr. Green paid?

## Making Sure of Multiplication Facts

Jim had a quarter and a fifty-cent piece. He bought 8 pencils at 6¢ each. He had to multiply quickly in order to know which coin to give the clerk. What multiplication fact did he have to know?

Many times you need to say the multiplication facts quickly. The tapping test is a good way to find out how well you know the basic multiplication facts.

Try Tapping Test One. As you say each product, tap the edge of your book.

### Tapping Test One

1.  $\begin{array}{r} 7 \\ \times 5 \\ \hline \end{array}$   $\begin{array}{r} 2 \\ \times 1 \\ \hline \end{array}$   $\begin{array}{r} 9 \\ \times 8 \\ \hline \end{array}$   $\begin{array}{r} 6 \\ \times 4 \\ \hline \end{array}$   $\begin{array}{r} 7 \\ \times 1 \\ \hline \end{array}$   $\begin{array}{r} 8 \\ \times 2 \\ \hline \end{array}$

2.  $\begin{array}{r} 9 \\ \times 9 \\ \hline \end{array}$   $\begin{array}{r} 1 \\ \times 5 \\ \hline \end{array}$   $\begin{array}{r} 7 \\ \times 8 \\ \hline \end{array}$   $\begin{array}{r} 1 \\ \times 6 \\ \hline \end{array}$   $\begin{array}{r} 9 \\ \times 7 \\ \hline \end{array}$   $\begin{array}{r} 1 \\ \times 8 \\ \hline \end{array}$

3.  $\begin{array}{r} 6 \\ \times 3 \\ \hline \end{array}$   $\begin{array}{r} 9 \\ \times 5 \\ \hline \end{array}$   $\begin{array}{r} 3 \\ \times 1 \\ \hline \end{array}$   $\begin{array}{r} 8 \\ \times 3 \\ \hline \end{array}$   $\begin{array}{r} 1 \\ \times 9 \\ \hline \end{array}$   $\begin{array}{r} 7 \\ \times 6 \\ \hline \end{array}$

4.  $\begin{array}{r} 6 \\ \times 8 \\ \hline \end{array}$   $\begin{array}{r} 1 \\ \times 2 \\ \hline \end{array}$   $\begin{array}{r} 9 \\ \times 3 \\ \hline \end{array}$   $\begin{array}{r} 8 \\ \times 7 \\ \hline \end{array}$   $\begin{array}{r} 8 \\ \times 1 \\ \hline \end{array}$   $\begin{array}{r} 8 \\ \times 6 \\ \hline \end{array}$

Was your tapping regular and reasonably fast? If not, do the tapping test again.

5. Copy all multiplication questions above that have 1 as one of

the numbers to be multiplied. What is always true of the product when one of the numbers to be multiplied is 1?

Now do Tapping Test Two.

### Tapping Test Two

6.  $\begin{array}{r} 6 \\ \times 5 \\ \hline \end{array}$   $\begin{array}{r} 7 \\ \times 7 \\ \hline \end{array}$   $\begin{array}{r} 9 \\ \times 0 \\ \hline \end{array}$   $\begin{array}{r} 6 \\ \times 2 \\ \hline \end{array}$   $\begin{array}{r} 9 \\ \times 2 \\ \hline \end{array}$   $\begin{array}{r} 7 \\ \times 3 \\ \hline \end{array}$

7.  $\begin{array}{r} 9 \\ \times 6 \\ \hline \end{array}$   $\begin{array}{r} 4 \\ \times 0 \\ \hline \end{array}$   $\begin{array}{r} 8 \\ \times 8 \\ \hline \end{array}$   $\begin{array}{r} 6 \\ \times 9 \\ \hline \end{array}$   $\begin{array}{r} 7 \\ \times 0 \\ \hline \end{array}$   $\begin{array}{r} 9 \\ \times 4 \\ \hline \end{array}$

8.  $\begin{array}{r} 8 \\ \times 9 \\ \hline \end{array}$   $\begin{array}{r} 0 \\ \times 6 \\ \hline \end{array}$   $\begin{array}{r} 7 \\ \times 9 \\ \hline \end{array}$   $\begin{array}{r} 5 \\ \times 0 \\ \hline \end{array}$   $\begin{array}{r} 6 \\ \times 7 \\ \hline \end{array}$   $\begin{array}{r} 9 \\ \times 3 \\ \hline \end{array}$

9.  $\begin{array}{r} 3 \\ \times 0 \\ \hline \end{array}$   $\begin{array}{r} 1 \\ \times 4 \\ \hline \end{array}$   $\begin{array}{r} 8 \\ \times 7 \\ \hline \end{array}$   $\begin{array}{r} 0 \\ \times 9 \\ \hline \end{array}$   $\begin{array}{r} 6 \\ \times 6 \\ \hline \end{array}$   $\begin{array}{r} 0 \\ \times 8 \\ \hline \end{array}$

Were you saying of the products and your tapping regular? If not, do the test again.

10. Copy all multiplication questions in Tapping Test Two that have 0 in either the multiplier or multiplicand. Write the products. What is always true of the product when one of the numbers to be multiplied is 0?

11. Copy. Multiply.

$\begin{array}{r} 516 \\ \times 7 \\ \hline \end{array}$   $\begin{array}{r} 322 \\ \times 8 \\ \hline \end{array}$   $\begin{array}{r} 409 \\ \times 6 \\ \hline \end{array}$   $\begin{array}{r} 684 \\ \times 9 \\ \hline \end{array}$   $\begin{array}{r} 508 \\ \times 5 \\ \hline \end{array}$



## Multiplication Questions Having a Zero or a One

### JOE

- There is an easy way to find the product when one of the figures to be multiplied is a 1.
- Whenever one of the figures to be multiplied is a 0, the product is always...

The teacher asked each pupil to explain about finding the product when 0 or 1 is one of the numbers to be multiplied.

1. Part of Joe's answer is shown above. Copy and complete each of his statements.

2. For each statement that you wrote give some examples to show what each means.

► Find the products. Think of the statements you wrote when there is a 0 or a 1 in your multiplication.

$$\begin{array}{r} 3. \quad 38 \quad 41 \quad 65 \quad 71 \\ \times 15 \quad \times 22 \quad \times 19 \quad \times 34 \end{array}$$

$$\begin{array}{r} 4. \quad 97 \quad 86 \quad 59 \quad 68 \\ \times 21 \quad \times 12 \quad \times 71 \quad \times 17 \end{array}$$

$$\begin{array}{r} 5. \quad 52 \quad 75 \quad 109 \quad 110 \\ \times 18 \quad \times 13 \quad \times 41 \quad \times 15 \end{array}$$

$$\begin{array}{r} 6. \quad 204 \quad 406 \quad 850 \quad 307 \\ \times 11 \quad \times 51 \quad \times 13 \quad \times 16 \end{array}$$

$$\begin{array}{r} 7. \quad 672 \quad 503 \quad 961 \quad 803 \\ \times 41 \quad \times 18 \quad \times 32 \quad \times 61 \end{array}$$

Answer these review questions. Show that your answer is correct.

8. Is the answer for  $38 \times 11$  the same as for  $38 \times 10$  plus  $38 \times 1$ ?

9. Is the answer for  $22 \times 21$  the same as for  $22 \times 20$  plus  $22$ ?

10. Is the answer for  $25 \times 40$  plus 25 the same as for  $25 \times 41$ ?

11. What are two ways to find the product of  $43 \times 31$ ?

12. Is the product of  $41 \times 13$  the same as the product of  $13 \times 41$ ?

13. Which of the following is an incorrect way to check the multiplication  $32 \times 13$ ?

$$32 \times 10 \text{ plus } 32 \times 3$$

$$32 \times 10 \text{ plus } 3$$

$$13 \times 32$$

$$32 \times 6 \text{ plus } 32 \times 7$$

?

► Copy. Multiply. Check by multiplying twice and adding the products.

$$\begin{array}{r} 14. \quad 63 \quad 45 \quad 54 \quad 61 \\ \times 12 \quad \times 16 \quad \times 22 \quad \times 32 \end{array}$$

## A Multiplication Inventory



To make an inventory, we count how much we have or find how much we know. Practice exercises on this page will help you make an inventory of the multiplication facts you know and those you need to study.

► Write products quickly. Use folded paper.

$$\begin{array}{r} 1. \quad 8 \quad 1 \quad 9 \quad 6 \quad 7 \quad 9 \\ \times 7 \quad \times 4 \quad \times 9 \quad \times 3 \quad \times 4 \quad \times 1 \end{array}$$

$$\begin{array}{r} 2. \quad 7 \quad 8 \quad 6 \quad 9 \quad 2 \quad 8 \\ \times 9 \quad \times 2 \quad \times 7 \quad \times 5 \quad \times 1 \quad \times 3 \end{array}$$

$$\begin{array}{r} 3. \quad 8 \quad 9 \quad 9 \quad 1 \quad 6 \quad 9 \\ \times 8 \quad \times 6 \quad \times 8 \quad \times 7 \quad \times 8 \quad \times 3 \end{array}$$

$$\begin{array}{r} 4. \quad 9 \quad 7 \quad 8 \quad 1 \quad 7 \quad 6 \\ \times 4 \quad \times 7 \quad \times 1 \quad \times 9 \quad \times 5 \quad \times 4 \end{array}$$

► Copy. Multiply. Check by using another way to multiply.

$$\begin{array}{r} 5. \quad 84 \quad 63 \quad 99 \quad 72 \quad 55 \\ \times 12 \quad \times 21 \quad \times 15 \quad \times 33 \quad \times 55 \end{array}$$

$$\begin{array}{r} 6. \quad 46 \quad 59 \quad 37 \quad 83 \quad 68 \\ \times 32 \quad \times 13 \quad \times 18 \quad \times 46 \quad \times 21 \end{array}$$

$$\begin{array}{r} 7. \quad 29 \quad 44 \quad 51 \quad 73 \quad 32 \\ \times 16 \quad \times 31 \quad \times 14 \quad \times 25 \quad \times 27 \end{array}$$

Multiply each number in a row by the number in the colored square at the beginning of the row. Write products only.

$$8. \quad \boxed{5} \quad 30 \quad 15 \quad 21 \quad 8 \quad 12$$

$$9. \quad \boxed{2} \quad 9 \quad 20 \quad 15 \quad 41 \quad 24$$

$$10. \quad \boxed{10} \quad 53 \quad 42 \quad 37 \quad 69 \quad 81$$

$$11. \quad \boxed{4} \quad 16 \quad 9 \quad 40 \quad 15 \quad 22$$

$$12. \quad \boxed{3} \quad 22 \quad 16 \quad 31 \quad 15 \quad 11$$

► Copy. Try to do rows 13 and 14 in 8 minutes. Time yourself.

$$13. \quad \begin{array}{r} 632 \quad 248 \quad 814 \quad 407 \\ \times 51 \quad \times 32 \quad \times 43 \quad \times 35 \end{array}$$

$$14. \quad \begin{array}{r} 916 \quad 561 \quad 306 \quad 229 \\ \times 81 \quad \times 24 \quad \times 52 \quad \times 78 \end{array}$$

15. What is the sum of  $25 \times 10$  plus  $25 \times 2$ ?

16. What number is twice 206?

17. Is the product of  $12 \times 5$  equal to the sum of  $12 \times 3$  plus  $31 \times 3$ ?

Does your inventory show that you know the basic facts and can give products with reasonable speed? If not, study them further. Pages 9, 35, and 36 have suggestions for study.



### Multiplication Study Suggestions

1. Do the tapping tests on page 32 again. This time try to make your tapping faster. Can you keep your tapping regular and improve your time?

2. Draw number lines to show facts you do not know well. What multiplication fact does this number line show?



3. Begin with 9. Count by 9's to 90. Say 9, 18, 27, and on. When you count in this way, you are saying the **multiples** of 9.

■ A **multiple** of a number is any larger number that contains the number without leaving a remainder.

4. Begin with 21. Say the multiples of 7 through 70. Is 49 a multiple of 7? Is 63?

5. Choose any number from 4 through 9. Begin with the number you choose and say the multiples. Stop when you reach 10 times the number.

6. Write addends whose sum is equal to the product of a multiplication fact, as  $6+6+6=18$  and  $3\times 6=18$ .

7. Write a rule for multiplying any number by 1. By 0. Page 33 will help you.

8. Write your own set of multiplication tables. Begin with 0 times the number and end with 9 times the number. Make a table for each number from 1 through 9. Here are the tables for the 3's and 8's.

| MULTIPLICATION TABLES |                |
|-----------------------|----------------|
| FOR 3's               | FOR 8's        |
| $0\times 3=0$         | $0\times 8=0$  |
| $1\times 3=3$         | $1\times 8=8$  |
| $2\times 3=6$         | $2\times 8=16$ |
| $3\times 3=9$         | $3\times 8=24$ |
| $4\times 3=12$        | $4\times 8=32$ |
| $5\times 3=15$        | $5\times 8=40$ |
| $6\times 3=18$        | $6\times 8=48$ |
| $7\times 3=21$        | $7\times 8=56$ |
| $8\times 3=24$        | $8\times 8=64$ |
| $9\times 3=27$        | $9\times 8=72$ |

9. Try to say all of the multiplication facts that have a product of 16.

10. Choose two different products such as 24 and 35, and try to say all the multiplication number questions for each product.

## More Multiplication Study Suggestions

1. Write each multiplication fact that you do not know well. Cover the products with a notched paper. Say one of the products. Move the paper to see if your answer is right.

|                                                           |                                                        |                                                           |                                                           |
|-----------------------------------------------------------|--------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------|
| $\begin{array}{r} 6 \\ \times 9 \\ \hline 54 \end{array}$ | $\begin{array}{r} 9 \\ \times 7 \\ \hline \end{array}$ | $\begin{array}{r} 7 \\ \times 9 \\ \hline 63 \end{array}$ | $\begin{array}{r} 8 \\ \times 8 \\ \hline 64 \end{array}$ |
|-----------------------------------------------------------|--------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------|

2. Cover the multipliers. Look at a multiplicand and product for any one of the facts. Say the multiplier.

► Copy. Multiply.

|                                                             |                                                          |                                                          |                                                          |
|-------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|
| 3. $\begin{array}{r} 821 \\ \times 1 \\ \hline \end{array}$ | $\begin{array}{r} 546 \\ \times 2 \\ \hline \end{array}$ | $\begin{array}{r} 793 \\ \times 3 \\ \hline \end{array}$ | $\begin{array}{r} 806 \\ \times 4 \\ \hline \end{array}$ |
| 4. $\begin{array}{r} 783 \\ \times 6 \\ \hline \end{array}$ | $\begin{array}{r} 965 \\ \times 7 \\ \hline \end{array}$ | $\begin{array}{r} 421 \\ \times 8 \\ \hline \end{array}$ | $\begin{array}{r} 602 \\ \times 9 \\ \hline \end{array}$ |
| 5. $\begin{array}{r} 529 \\ \times 5 \\ \hline \end{array}$ | $\begin{array}{r} 789 \\ \times 9 \\ \hline \end{array}$ | $\begin{array}{r} 638 \\ \times 6 \\ \hline \end{array}$ | $\begin{array}{r} 458 \\ \times 4 \\ \hline \end{array}$ |

6. Try to explain a short way of multiplying any number by 10. Use the example  $10 \times 24$ .

■ A quick way to multiply a number by 10 is to annex, or place, a 0 to the right of the number.

7. Use this quick way to multiply each of these numbers by 10.

24 15 40 12 25 33 42

8. Try to explain a short way to multiply any number by an exact tens number. Use the example  $20 \times 37$ .

■ A quick way to multiply any number by an exact tens number is to write a zero in ones place and multiply by the tens number.

9. Use this quick method to multiply each number in example 7 by 20.

10. Try different ways of finding the product. Explain what was done in each of the ways below.

|                                                                |                                                                                       |                                                                                               |
|----------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| A. $\begin{array}{r} 27 \\ \times 8 \\ \hline 216 \end{array}$ | B. $\begin{array}{r} 27 \\ \times 4 \\ \hline 108 \\ + 108 \\ \hline 216 \end{array}$ | C. $\begin{array}{r} 27 \\ 27 \\ 27 \\ + 27 \\ \hline 108 \\ + 108 \\ \hline 216 \end{array}$ |
|----------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|

Show in two different ways how to find products for these examples.

|                                                             |                                                         |                                                         |                                                          |                                                          |
|-------------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|
| 11. $\begin{array}{r} 46 \\ \times 8 \\ \hline \end{array}$ | $\begin{array}{r} 83 \\ \times 6 \\ \hline \end{array}$ | $\begin{array}{r} 54 \\ \times 4 \\ \hline \end{array}$ | $\begin{array}{r} 39 \\ \times 12 \\ \hline \end{array}$ | $\begin{array}{r} 63 \\ \times 16 \\ \hline \end{array}$ |
|-------------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|

See how rapidly you can give the missing numbers.

|                                                                     |                                                                 |                                                                 |                                                                 |                                                                 |                                                                 |
|---------------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|
| 12. $\begin{array}{r} 7 \\ \times \square \\ \hline 63 \end{array}$ | $\begin{array}{r} 8 \\ \times \square \\ \hline 56 \end{array}$ | $\begin{array}{r} 9 \\ \times \square \\ \hline 54 \end{array}$ | $\begin{array}{r} 8 \\ \times \square \\ \hline 72 \end{array}$ | $\begin{array}{r} 6 \\ \times \square \\ \hline 48 \end{array}$ | $\begin{array}{r} 9 \\ \times \square \\ \hline 81 \end{array}$ |
|---------------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|



## Problem Solving



BETTY

Problem 1

$$\begin{array}{r} 11,294 \\ - 10,318 \\ \hline \end{array}$$

Problem 2

$$\begin{array}{r} \$150.00 \\ 3.20 \\ + 36.40 \\ \hline \end{array}$$

?

Betty read problem 1 and problem 2 below. Then she wrote the number questions given above. What mistake did she make?

1. Mr. Dale drives his car an average of 1000 miles a week. Last week when he started driving, the speedometer on his car read 10,318. At the end of the week it read 11,294. How many miles did he drive that week?

2. Mr. Smith was allowed \$150 for expenses on a trip. He paid \$86.40 for his airplane ticket, \$3.20 for his taxicab fare, and \$36.40 for his hotel room and meals. What was the total amount of his expenses?

3. The area of North America is 8,589,257 square miles. The area of South America is 7,570,015 square miles. How many square miles are there in the two continents together?

4. Mr. James went on a three-

day trip. He drove his car an average of 45 miles per hour. At this rate how far did he travel in 12 hours?

5. John got \$15.00 for his birthday. He saw a catcher's mitt that cost \$6.65 at one store, and another mitt that cost \$5.85 at another store. How much will he save if he buys the cheaper mitt?

6. Mrs. North saved \$395.00 to buy a living room sofa. She saw a sofa advertised at \$357.50. How much will she have left if she buys this sofa?

### Special Addition Practice

Write sums on folded paper. Check.

|    |     |      |       |       |
|----|-----|------|-------|-------|
| 5  | 72  | 837  | 9743  | 2895  |
| 8  | 67  | 368  | 6325  | 8493  |
| 5  | 64  | 349  | 3968  | 9248  |
| 6  | 48  | 455  | 7346  | 3182  |
| 8  | 86  | 689  | 6859  | 1186  |
| +5 | +59 | +475 | +3798 | +3154 |

$$\begin{array}{r}
 \text{BILL} \quad 543 \\
 \times 976 \\
 \hline
 3258 \rightarrow \text{first partial product} \\
 3801 \rightarrow \text{second partial product} \\
 4887 \rightarrow \text{third partial product} \\
 \hline
 529,968
 \end{array}$$

$$\begin{array}{r}
 \text{JOAN} \quad 543 \\
 \times 976 \\
 \hline
 \text{THINK} \\
 6 \times 543 = \rightarrow 3258 \\
 70 \times 543 = \rightarrow 38010 \\
 900 \times 543 = \rightarrow 488700 \\
 \hline
 976 \times 543 = \rightarrow 529,968
 \end{array}$$

### Using Three-Place Multipliers

1. Bill multiplied 543 by 976. The teacher asked him to label each partial product. Did Bill label the partial products correctly?

2. How many partial products are there when the multiplier is a three-place number?

3. How many partial products will there be when the multiplier is a two-place number?

4. How many partial products will there be in  $2355 \times 5280$ ?

Bill said, "Every time I write another partial product, I begin one place farther to the left. Why must I do this?" Joan put her work on the board to help Bill.

5. Why did Joan think 70 when she multiplied by 7?

6. Explain why Joan thought 900 when she multiplied by 9.

7. Explain how Joan's work answers Bill's question.

Jerry said, "I think I have an

easy way to answer Bill's question." Then Jerry wrote this.

$$\begin{array}{r}
 543 \quad \text{JERRY} \\
 \times 976 \\
 \hline
 3258 \text{ ones partial product} \\
 3801 \rightarrow \text{tens partial product} \\
 4887 \rightarrow \text{hundreds partial product} \\
 \hline
 529,968
 \end{array}$$

8. Why do you think Jerry called the first partial product the ones partial product?

9. How did he label the second partial product? The third? Why?

► Copy. Multiply. Check by interchanging the multiplier and the multiplicand.

$$\begin{array}{r}
 10. \quad 467 \quad 528 \quad 659 \quad 839 \\
 \times 183 \quad \times 236 \quad \times 473 \quad \times 417
 \end{array}$$

$$\begin{array}{r}
 11. \quad 752 \quad 986 \quad 587 \quad 698 \\
 \times 258 \quad \times 896 \quad \times 814 \quad \times 961
 \end{array}$$

$$\begin{array}{r}
 12. \quad 378 \quad 795 \quad 253 \quad 562 \\
 \times 495 \quad \times 538 \quad \times 379 \quad \times 476
 \end{array}$$



|     |               |       |               |     |               |       |               |
|-----|---------------|-------|---------------|-----|---------------|-------|---------------|
| DON | 365           | ALICE | 365           | BOB | 296           | CAROL |               |
|     | $\times 150$  |       | $\times 150$  |     | $\times 300$  |       |               |
|     | <u>000</u>    |       | <u>000</u>    |     | <u>000</u>    |       | 296           |
|     | 1825          |       | 18250         |     | 000           |       | $\times 300$  |
|     | 365           |       | 365           |     | 888           |       | <u>88,800</u> |
|     | <u>54,750</u> |       | <u>54,750</u> |     | <u>88,800</u> |       |               |

### Zeros in Three-Place Multipliers

Don and Alice wanted to find out how many days there would be in 150 years. They knew that there are 365 days in the average year.

1. Look at the illustration above. How did Don show ones partial product in his multiplication?

2. How did Alice show ones partial product in her multiplication?

3. Which way of multiplying do you think is better, Don's or Alice's? Who used the shorter way?

4. Multiply as Alice did.

$$\begin{array}{r} 463 \\ \times 450 \\ \hline \end{array} \quad \begin{array}{r} 715 \\ \times 270 \\ \hline \end{array} \quad \begin{array}{r} 896 \\ \times 120 \\ \hline \end{array} \quad \begin{array}{r} 395 \\ \times 350 \\ \hline \end{array} \quad \begin{array}{r} 278 \\ \times 480 \\ \hline \end{array}$$

Bob and Carol solved this problem: A refreshment stand uses an average of 296 oranges a day. How many oranges will be used in 300 days?

5. Look at the illustration above. How did Bob show ones partial product when he multiplied? How

did he show tens partial product?

6. Carol multiplied in a shorter way. Tell how she wrote ones partial product. Tens partial product.

7. Multiply as Carol did.

$$\begin{array}{r} 124 \\ \times 400 \\ \hline \end{array} \quad \begin{array}{r} 537 \\ \times 600 \\ \hline \end{array} \quad \begin{array}{r} 625 \\ \times 200 \\ \hline \end{array} \quad \begin{array}{r} 350 \\ \times 700 \\ \hline \end{array} \quad \begin{array}{r} 375 \\ \times 300 \\ \hline \end{array}$$

Ann and Joe multiplied to find how many oranges there are in 206 crates if one crate holds 288 oranges. Look at their work.

|     |               |     |               |
|-----|---------------|-----|---------------|
| ANN | 288           | JOE | 288           |
|     | $\times 206$  |     | $\times 206$  |
|     | <u>000</u>    |     | <u>000</u>    |
|     | 1728          |     | 1728          |
|     | <u>576</u>    |     | <u>5760</u>   |
|     | <u>59,328</u> |     | <u>59,328</u> |

8. Who used the shorter way?

9. How did Ann show tens partial product? How did Joe show it?

10. Use Joe's way. Multiply 572 by 302.

|                                                                  |                                                                     |                                                                                              |      |                                                                                                       |      |
|------------------------------------------------------------------|---------------------------------------------------------------------|----------------------------------------------------------------------------------------------|------|-------------------------------------------------------------------------------------------------------|------|
| MARY                                                             | BILL                                                                | FRED                                                                                         | 4006 | JOAN                                                                                                  | 2300 |
| A. $\begin{array}{r} 240 \\ \times 6 \\ \hline 1440 \end{array}$ | B. $\begin{array}{r} 5060 \\ \times 3 \\ \hline 15,180 \end{array}$ | c. $\begin{array}{r} 4006 \\ \times 24 \\ \hline 16024 \\ 8012 \\ \hline 96,144 \end{array}$ |      | D. $\begin{array}{r} 2300 \\ \times 232 \\ \hline 4600 \\ 6900 \\ 4600 \\ \hline 533,600 \end{array}$ |      |

### Zeros in Multiplication

Joan's class had these multiplication problems to do.

|                                                               |                                                                |
|---------------------------------------------------------------|----------------------------------------------------------------|
| A. $\begin{array}{r} 240 \\ \times 6 \\ \hline \end{array}$   | B. $\begin{array}{r} 5060 \\ \times 3 \\ \hline \end{array}$   |
| C. $\begin{array}{r} 4006 \\ \times 24 \\ \hline \end{array}$ | D. $\begin{array}{r} 2300 \\ \times 232 \\ \hline \end{array}$ |

The teacher said, "There are one or more zeros in each of the multiplicands in examples A-D. Does that make the multiplication difficult?"

Joan said, "The multiplication is easy. We multiply the zeros just as we multiply the other figures in the multiplicand. If there is a number to be carried in any place, we add it to the product 0."

1. Review page 33. Look at the work above. Explain how each child got any product or partial product figure that is written in color.

► Copy. Find the products.

$$\begin{array}{r} 2. \quad 406 \\ \times 7 \\ \hline \end{array} \quad \begin{array}{r} 390 \\ \times 5 \\ \hline \end{array} \quad \begin{array}{r} 560 \\ \times 2 \\ \hline \end{array} \quad \begin{array}{r} 300 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 3. \quad 300 \\ \times 5 \\ \hline \end{array} \quad \begin{array}{r} 508 \\ \times 7 \\ \hline \end{array} \quad \begin{array}{r} 803 \\ \times 24 \\ \hline \end{array} \quad \begin{array}{r} 870 \\ \times 35 \\ \hline \end{array}$$

$$\begin{array}{r} 4. \quad 305 \\ \times 64 \\ \hline \end{array} \quad \begin{array}{r} 400 \\ \times 38 \\ \hline \end{array} \quad \begin{array}{r} 900 \\ \times 25 \\ \hline \end{array} \quad \begin{array}{r} 630 \\ \times 27 \\ \hline \end{array}$$

► Copy. Find the products. If you need help with zeros, study again pages 33 and 39 and the work at the top of this page.

$$\begin{array}{r} 5. \quad 390 \\ \times 58 \\ \hline \end{array} \quad \begin{array}{r} 203 \\ \times 30 \\ \hline \end{array} \quad \begin{array}{r} 870 \\ \times 67 \\ \hline \end{array} \quad \begin{array}{r} 307 \\ \times 90 \\ \hline \end{array}$$

$$\begin{array}{r} 6. \quad 730 \\ \times 34 \\ \hline \end{array} \quad \begin{array}{r} 869 \\ \times 307 \\ \hline \end{array} \quad \begin{array}{r} 508 \\ \times 406 \\ \hline \end{array} \quad \begin{array}{r} 703 \\ \times 802 \\ \hline \end{array}$$

$$\begin{array}{r} 7. \quad 107 \\ \times 830 \\ \hline \end{array} \quad \begin{array}{r} 320 \\ \times 501 \\ \hline \end{array} \quad \begin{array}{r} 382 \\ \times 980 \\ \hline \end{array} \quad \begin{array}{r} 493 \\ \times 302 \\ \hline \end{array}$$

$$\begin{array}{r} 8. \quad 209 \\ \times 137 \\ \hline \end{array} \quad \begin{array}{r} 311 \\ \times 892 \\ \hline \end{array} \quad \begin{array}{r} 425 \\ \times 250 \\ \hline \end{array} \quad \begin{array}{r} 873 \\ \times 638 \\ \hline \end{array}$$

$$\begin{array}{r} 9. \quad 738 \\ \times 496 \\ \hline \end{array} \quad \begin{array}{r} 793 \\ \times 900 \\ \hline \end{array} \quad \begin{array}{r} 395 \\ \times 200 \\ \hline \end{array} \quad \begin{array}{r} 816 \\ \times 500 \\ \hline \end{array}$$



## Multiplying Money Numbers

Mrs. Brown pays \$3.75 a sack for chicken feed. What will 3 sacks cost?

1. Tom said 3 sacks of feed would cost \$1125. Does that answer seem sensible?

| TOM                                                                | RUTH                                                                   |
|--------------------------------------------------------------------|------------------------------------------------------------------------|
| $\begin{array}{r} \$3.75 \\ \times 3 \\ \hline \$1125 \end{array}$ | $\begin{array}{r} 3.75 \\ 3.75 \\ +3.75 \\ \hline \$11.25 \end{array}$ |

2. Check Tom's multiplication and find his mistake.

3. Ruth said, "I know Tom should have a decimal point in his answer. I found my answer by adding. My answer shows dollars and cents."

4. Do Tom's multiplication and write the answer correctly.

■ When the **multiplicand** is a money number having dollars and cents, the **product** must show dollars and cents.

■ Put a **decimal point** in the product so there will be two places at the right of the decimal point for cents.

5. Mr. Brown bought a farm. He arranged to pay \$85.90 each

month. How much will he pay off in 120 monthly payments?

6. Mary Brown picked 75 bu. of peaches. She sold them at \$2.75 a bushel. How much did she get for all the peaches?

7. Mary's brother sold 54 lb. of spinach at 15¢ a pound. How much did he get for all the spinach? Which do you think is the better way to find the answer, A or B? Why?

|                                                                                                                                                |                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| <p>A. <math display="block">\begin{array}{r} 15\text{¢} \\ \times 54 \\ \hline 60 \\ 75 \\ \hline 810\text{¢} = \\$8.10 \end{array}</math></p> | <p>B. <math display="block">\begin{array}{r} \\$1.15 \\ \times 54 \\ \hline 60 \\ 75 \\ \hline \\$8.10 \end{array}</math></p> |
|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|

How much will Farmer Brown receive for each of the following?

8. 42 doz. ears of corn @ 50¢ a dozen.

9. 7 boxes of lettuce at \$5.85 a box.

10. 65 sacks of potatoes at \$5.90 a sack.

11. 85 dozen eggs at \$.55 a dozen.

12. 350 bushels of tomatoes at \$2.50 a bushel.

13. 104 crates of berries at \$5.20 a crate.

## Things to Remember When Multiplying



Sam was helping Mr. West get ready for a week-end sale. Mr. West said, "I am going to put the canned tomatoes on sale. Find how many cans there are."

Sam knew there were 24 cans of tomatoes in a case. He counted 125 cases. He then multiplied the easier way, and found that there were 3000 cans.

| ONE WAY<br>TO MULTIPLY                                                                   | EASIER WAY<br>TO MULTIPLY                                                           |
|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| $\begin{array}{r} 24 \\ \times 125 \\ \hline 120 \\ 48 \\ 24 \\ \hline 3000 \end{array}$ | $\begin{array}{r} 125 \\ \times 24 \\ \hline 500 \\ 250 \\ \hline 3000 \end{array}$ |

1. Explain the easier way. Why is it easier?

■ It is usually easier to find the product if you use the **smaller** number as the **multiplier**. The meaning of the problem will tell you how to name your answer.

2. Sam counted 48 small cans of beans in a case. How many cans were there in 102 cases?

► Multiply the easier way.

$$\begin{array}{r} 56 \\ \times 327 \\ \hline \end{array} \quad \begin{array}{r} 6 \\ \times 178 \\ \hline \end{array} \quad \begin{array}{r} 29 \\ \times 5835 \\ \hline \end{array}$$

$$\begin{array}{r} 32 \\ \times 1400 \\ \hline \end{array} \quad \begin{array}{r} 7 \\ \times 1528 \\ \hline \end{array} \quad \begin{array}{r} \$0.04 \\ \times 8175 \\ \hline \end{array}$$

$$\begin{array}{r} \$0.18 \\ \times 7542 \\ \hline \end{array} \quad \begin{array}{r} \$0.05 \\ \times 248 \\ \hline \end{array} \quad \begin{array}{r} \$0.42 \\ \times 283 \\ \hline \end{array}$$

6. Jack bought 3 notebooks at 25¢ each. How much did he spend? Jack said he could find the product in two ways. Explain each way.

| JACK                                                         |                                                                    |
|--------------------------------------------------------------|--------------------------------------------------------------------|
| $\begin{array}{r} 25¢ \\ \times 3 \\ \hline 75¢ \end{array}$ | $\begin{array}{r} \$0.25 \\ \times 3 \\ \hline \$0.75 \end{array}$ |

■ In **multiplying money numbers**, you may use either the cents sign or the dollar sign and decimal point if your answer is less than \$1.00.

7. How much would Jack have paid for 4 notebooks at 15 cents each?

8. Joan bought 3 yards of cloth at 89¢ a yard. How much did she pay for the cloth? Joan found the



answer in two ways. Which way is most often used?

| JOAN                                                                   |                                                                    |
|------------------------------------------------------------------------|--------------------------------------------------------------------|
| $\begin{array}{r} 89¢ \\ \times 3 \\ \hline 267¢ = \$2.67 \end{array}$ | $\begin{array}{r} \$ .89 \\ \times 3 \\ \hline \$2.67 \end{array}$ |

■ In multiplying money numbers, use the dollar sign and decimal point in the multiplicand and in the product if your answer is \$1.00 or more.

9. At 59 cents a pound, what will a 5-pound box of candy cost?

10. At 35¢ a yard, what will 25 yards of ribbon cost?

11. Jim bought 15 cupcakes at five cents each. How much did he spend?

12. Jane pays 25 cents a month club dues. What are her dues for 12 months, or 1 year?

13. Jim gets thirty-five cents a week for spending money. How much spending money does he get in 52 weeks, or 1 year?

14. Tom earns 85¢ an hour. How much will he earn in 8 hours?

Do not use your pencil. Think. Then say the answer.

15. Which is more,  $71 \times 30$ , or  $81 \times 20$ ? You can answer quickly

if you think of the tens in each number.

16. What number is 3 times as large as 56?

17. What is the sum of  $22 \times 10$  plus  $22 \times 2$ ?

18. Is the product of  $30 \times 8$  double the product of  $30 \times 4$ ?

19. When you count by 9's, what is the next number after 216?

### Mixed Practice

► Copy. Find the answers.

$$\begin{array}{r} 508 \\ \times 43 \\ \hline \end{array} \quad \begin{array}{r} 518 \\ - 405 \\ \hline \end{array} \quad \begin{array}{r} \$ .87 \\ \times 95 \\ \hline \end{array} \quad \begin{array}{r} \$ .50 \\ + .37 \\ \hline \end{array}$$

$$\begin{array}{r} \$4.75 \\ \times 17 \\ \hline \end{array} \quad \begin{array}{r} 900 \\ - 99 \\ \hline \end{array} \quad \begin{array}{r} 840 \\ \times 265 \\ \hline \end{array} \quad \begin{array}{r} \$8.37 \\ - .25 \\ \hline \end{array}$$

$$\begin{array}{r} 10957 \\ \times 7443 \\ \hline \end{array} \quad \begin{array}{r} \$ .02 \\ \times 465 \\ \hline \end{array} \quad \begin{array}{r} 256 \\ \times 650 \\ \hline \end{array} \quad \begin{array}{r} 189 \\ \times 308 \\ \hline \end{array}$$

$$\begin{array}{r} \$45.50 \\ 12.95 \\ .78 \\ + 6.25 \\ \hline \end{array} \quad \begin{array}{r} \$17.49 \\ - 10.09 \\ \hline \end{array} \quad \begin{array}{r} \$125.00 \\ + 4.99 \\ \hline \end{array}$$

$$\begin{array}{r} 5280 \\ \times 400 \\ \hline \end{array} \quad \begin{array}{r} 43560 \\ \times 9 \\ \hline \end{array} \quad \begin{array}{r} 61039 \\ + 261 \\ \hline \end{array}$$

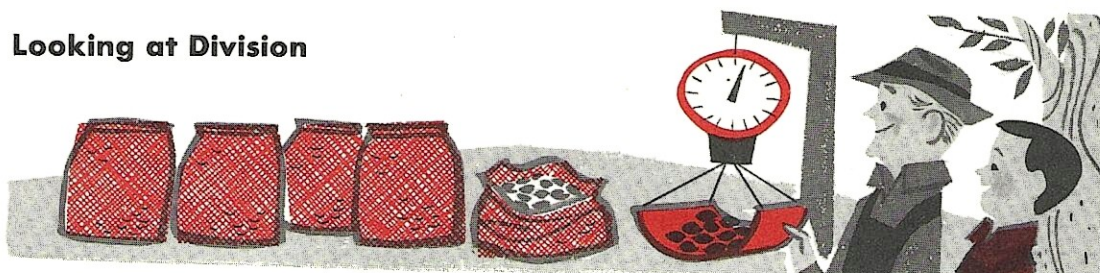
6. Subtract \$3.75 from \$15.02.

7.  $\$.19 + \$4.60 + \$.05 + \$12.89$   
= □

8. Subtract \$2.38 from \$14.52.

9. Multiply 3146 by 300.

## Looking at Division



Mr. Smith promised to pay 5 cents a pound for all the pecans Jack and five other boys gathered in his pecan orchard. The 6 boys gathered 726 pounds of pecans.

Jack thought, "My part is  $\frac{1}{6}$  of 726. That is  $726 \div 6$ . I know that  $100 \text{ } 6\text{'s} = 600$ .  $726 - 600$  leaves 126 pounds to be divided. I know that  $10 \text{ } 6\text{'s} = 60$ .  $126 - 60$  leaves 66 pounds still to be divided. That means my share is more than 110 pounds."

1. Do you think Jack's estimate of more than 110 pounds is correct?

2. Jack then used pencil and paper and finished the division. He said his share was 121 pounds. How did he get this amount?

3. Why do you think Jack wrote 100 for his first quotient figure?

4. After getting 100, how many 10's did each of the 6 boys get?

$$\begin{array}{r} 100 \\ 6 \overline{)726} \\ \underline{-600} \\ 126 \\ \underline{-60} \\ 66 \\ \underline{-60} \\ 6 \\ \underline{-6} \\ 0 \end{array}$$

5. How many pounds were there in each boy's share? How do you know?

6. Use Jack's way of writing 100's, 10's, and 1's in the quotient and do these divisions. Check by dividing in the usual way.

$$9 \overline{)1089} \quad 6 \overline{)816} \quad 5 \overline{)635} \quad 4 \overline{)1432}$$

The 100's and 10's method of showing division cannot be used when the quotient has a figure only in ones place. A good way to explain such division is by subtracting.

7. Explain how the example at the right shows how many 43's equal 129.

$$\begin{array}{r} 129 \\ -43 \\ \hline 86 \\ -43 \\ \hline 43 \\ -43 \\ \hline 0 \end{array}$$

8. Find the quotients for these examples by subtracting.

$$24 \overline{)96} \quad 19 \overline{)57} \quad 18 \overline{)72} \quad 48 \overline{)336}$$

9. Check the quotients you found for the examples in question 8 by dividing in the usual way.



10. Joan, Bill, and Mary tried to divide using the 100's, 10's, and 1's way of finding the quotient. Two of them did their work correctly. One did not. Find the mistake.

11. Divide in the usual way and see if you get the same quotients that Joan, Bill, and Mary did.

| JOAN                                                                                                                             | BILL                                                                                                                               | MARY                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| $\begin{array}{r} 1 \\ 20 \\ 200 \\ 9 \overline{)1989} \\ -1800 \\ \hline 189 \\ -180 \\ \hline 9 \\ -9 \\ \hline 0 \end{array}$ | $\begin{array}{r} 2 \\ 30 \\ 200 \\ 8 \overline{)1856} \\ -1600 \\ \hline 256 \\ -240 \\ \hline 16 \\ -16 \\ \hline 0 \end{array}$ | $\begin{array}{r} 1 \\ 200 \\ 300 \\ 7 \overline{)2247} \\ -2100 \\ \hline 147 \\ -140 \\ \hline 7 \\ -7 \\ \hline 0 \end{array}$ |

### Reviewing the Basic Division Facts

You cannot divide well in the way that Jack did or in the usual way unless you know the basic division facts well.

Test yourself. Try to say all the quotients for the division questions in this tapping test. As you say each quotient, tap the edge of your book.

### Division Tapping Test

- $6 \overline{)30}$     $7 \overline{)28}$     $5 \overline{)5}$     $9 \overline{)18}$
- $8 \overline{)8}$     $7 \overline{)21}$     $6 \overline{)6}$     $8 \overline{)40}$
- $6 \overline{)12}$     $3 \overline{)3}$     $7 \overline{)49}$     $4 \overline{)4}$
- $6 \overline{)42}$     $7 \overline{)35}$     $5 \overline{)40}$     $9 \overline{)72}$
- $6 \overline{)48}$     $7 \overline{)42}$     $8 \overline{)16}$     $9 \overline{)36}$
- $7 \overline{)7}$     $9 \overline{)54}$     $8 \overline{)32}$     $2 \overline{)2}$

7.  $6 \overline{)24}$     $9 \overline{)81}$     $9 \overline{)63}$     $8 \overline{)56}$

8.  $9 \overline{)45}$     $9 \overline{)9}$     $8 \overline{)48}$     $9 \overline{)27}$

9.  $8 \overline{)72}$     $6 \overline{)54}$     $8 \overline{)24}$     $4 \overline{)36}$

10. Copy each number question in which a number is divided by itself. Write the quotients. What do you find is always the quotient when a number is divided by itself?

Were there some facts that you did not know when you said the answers to the division questions? Were you slow in giving some of the quotients? If so, you need to study the division facts.

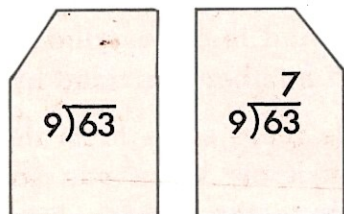
11. Turn to page 326. Write the quotients for these division questions. Keep a list of those you find that you do not know. Study these in the ways given on the next page.

## Division Study Suggestions

Are there some basic division facts you do not know? Do you need to improve your speed in giving answers? Try these suggestions for study.

1. Write the facts you need to study. Read each one carefully. Close your eyes. Say the fact to yourself. Write it. Look at the fact you are studying. Did you say and write it correctly? If not, study the fact again.

2. Make some division fact cards. Write the division question on one side. Write the fact on the other. Look at the question side. Try to say the fact correctly. Turn the card and see if you were right.



3. Write the facts you want to know well. Use a notched card to cover the quotient. Say the quotient. Move the card and see if you were right.

$$\begin{array}{r} 6 \\ 9 \overline{)54} \end{array} \quad \begin{array}{r} 7 \\ 8 \overline{)56} \end{array} \quad \begin{array}{r} 9 \\ 7 \overline{)63} \end{array} \quad \begin{array}{r} \phantom{0} \\ 8 \overline{)72} \end{array}$$

4. Write 25 basic division questions. Use them for a tapping test. When you can tap regularly and reasonably fast as you give the quotients, make another set of basic division questions and try the tapping test again. Do this until you know every basic division fact well.

► Divide. Check by subtracting.

$$5. \quad 11 \overline{)33} \quad 12 \overline{)48} \quad 9 \overline{)108} \quad 24 \overline{)48}$$

$$6. \quad 19 \overline{)38} \quad 34 \overline{)102} \quad 13 \overline{)65} \quad 51 \overline{)153}$$

$$7. \quad 14 \overline{)56} \quad 21 \overline{)63} \quad 62 \overline{)124} \quad 18 \overline{)90}$$

► Copy. Write the missing divisor.

$$8. \quad \begin{array}{r} 6 \\ \square \overline{)72} \end{array} \quad \begin{array}{r} 21 \\ \square \overline{)84} \end{array} \quad \begin{array}{r} 48 \\ \square \overline{)96} \end{array} \quad \begin{array}{r} 22 \\ \square \overline{)66} \end{array}$$

$$9. \quad \begin{array}{r} 9 \\ \square \overline{)81} \end{array} \quad \begin{array}{r} 5 \\ \square \overline{)60} \end{array} \quad \begin{array}{r} 24 \\ \square \overline{)72} \end{array} \quad \begin{array}{r} 14 \\ \square \overline{)98} \end{array}$$

$$10. \quad \begin{array}{r} 44 \\ \square \overline{)88} \end{array} \quad \begin{array}{r} 3 \\ \square \overline{)75} \end{array} \quad \begin{array}{r} 7 \\ \square \overline{)49} \end{array} \quad \begin{array}{r} 18 \\ \square \overline{)90} \end{array}$$

► Copy. Divide. Check by multiplying quotient and divisor.

$$11. \quad 5 \overline{)1565} \quad 3 \overline{)1959} \quad 6 \overline{)4212}$$

$$12. \quad 4 \overline{)1768} \quad 7 \overline{)2814} \quad 8 \overline{)5088}$$

$$13. \quad 9 \overline{)2799} \quad 5 \overline{)3605} \quad 7 \overline{)3024}$$



## A Counting Chart

|    | 10  | 11  | 12  | 13  | 14  | 15  |
|----|-----|-----|-----|-----|-----|-----|
| 1  | 10  | 11  | 12  | 13  | 14  | 15  |
| 2  | 20  | 22  | 24  | 26  | 28  | 30  |
| 3  | 30  | 33  | 36  | 39  | 42  | 45  |
| 4  | 40  | 44  | 48  | 52  | 56  | 60  |
| 5  | 50  | 55  | 60  | 65  | 70  | 75  |
| 6  | 60  | 66  | 72  | 78  | 84  | 90  |
| 7  | 70  | 77  | 84  | 91  | 98  | 105 |
| 8  | 80  | 88  | 96  | 104 | 112 | 120 |
| 9  | 90  | 99  | 108 | 117 | 126 | 135 |
| 10 | 100 | 110 | 120 | 130 | 140 | 150 |

Bill said, "I saw this counting chart in a book. The numbers in color are guide numbers. Look at the guide numbers 14 and 4. What is their product?"

Guide numbers may be used as divisors and quotients. For example, six 15's equal 90. How many 15's equal 135?

Use the chart to answer these questions.

1. How many 14's equal 126?
2. How many are nine 12's?
3. What is the next number after 117 if you count from 26 by 13's?
4. How many 14's equal 112? How many are eight 14's? Write

these two facts. What do you notice? What does the chart show about multiplication and division?



Make a counting chart. Use the same guide numbers along the side. At the top use 16 through 20 for the guide numbers. What will you do to find what black numbers to write?

► Use your chart. Give the answers.

$$5. \quad 19 \overline{)114} \quad 18 \overline{)162} \quad 17 \overline{)153}$$

$$6. \quad 16 \overline{)144} \quad 19 \overline{)152} \quad 18 \overline{)108}$$

$$7. \quad 20 \overline{)160} \quad 17 \overline{)119} \quad 17 \overline{)136}$$

$$8. \quad \begin{array}{r} 19 \\ \times 8 \end{array} \quad \begin{array}{r} 17 \\ \times 4 \end{array} \quad \begin{array}{r} 16 \\ \times 9 \end{array} \quad \begin{array}{r} 18 \\ \times 9 \end{array} \quad \begin{array}{r} 16 \\ \times 7 \end{array} \quad \begin{array}{r} 19 \\ \times 9 \end{array}$$

► Copy. Write the multiplication fact whose product is equal to the dividend, as:

$$\begin{array}{r} 9 \\ 14 \overline{)126} \end{array}$$

$$14 \times 9 = 126$$

$$\text{or } 9 \times 14 = 126$$

$$9. \quad 19 \overline{)114} \quad 12 \overline{)156} \quad 16 \overline{)80}$$

$$10. \quad 17 \overline{)153} \quad 14 \overline{)154} \quad 15 \overline{)120}$$

$$11. \quad 17 \overline{)102} \quad 18 \overline{)144} \quad 13 \overline{)117}$$

BETTY

$$\begin{array}{r} 280 \\ -40 \leftarrow 1 \\ \hline 240 \\ -40 \leftarrow 2 \\ \hline 200 \\ -40 \leftarrow 3 \\ \hline 160 \\ -40 \leftarrow 4 \\ \hline 120 \end{array}$$

TOM

$$\begin{array}{r} 40 \overline{)280} \\ 280 = 28 \text{ tens} \\ 40 = 4 \text{ tens} \\ \hline 7 \\ 4 \text{ tens} \overline{)28 \text{ tens}} \end{array}$$

JIM

$$\begin{array}{r} \text{divisor} \downarrow \quad 7 \text{ quotient} \\ 40 \overline{)280} \text{ dividend} \\ -280 \text{ (} 7 \times 40 \text{)} \\ \hline 0 \end{array}$$

### Using Two-Place Divisors

Jim told Tom and Betty that it was 280 miles from their town to Chicago. Tom wondered how long it would take to drive to Chicago if an automobile traveled an average of 40 miles an hour.

1. Look at the work at the top of the page. Explain how Betty started to find the answer.

2. How did Tom find the answer?

3. Jim used a two-place divisor. He tried 2 as a trial dividend and 4 as a trial divisor. Why did he have to change his trial dividend?

4. Jim then tried 28 as his trial dividend. He divided 28 by 4. His quotient figure was 7. Why did Jim write the 7 in ones place in the quotient? If you cannot

answer, Tom's work may help you.

5. Explain how Jim completed his division.

6. How can you check to be sure that Jim's quotient is correct?

■ When the first figure of the dividend is smaller than the trial divisor, use the **first two figures** of the dividend as the trial dividend.

► Copy. Find the quotients. Check.

7.  $54 \overline{)216}$      $44 \overline{)176}$      $35 \overline{)105}$

8.  $83 \overline{)415}$      $83 \overline{)166}$      $43 \overline{)344}$

9.  $72 \overline{)432}$      $53 \overline{)371}$      $72 \overline{)648}$

10.  $42 \overline{)126}$      $35 \overline{)140}$      $65 \overline{)260}$

11.  $85 \overline{)170}$      $75 \overline{)150}$      $62 \overline{)310}$

12.  $53 \overline{)159}$      $94 \overline{)282}$      $41 \overline{)246}$



## Reviewing the Steps in Division with Two-Place Divisors



There are 24 pupils in Ann's class. They want to write 78 invitations asking fifth-graders to a Halloween party. If each pupil writes an equal number, will all of the invitations be written?

1. To find out, Ann divided. How many invitations must each pupil write? How many will be left to write after each pupil has written an equal number? How did Ann show the left-over part?

| ANN                                                                                            | CHECK                                                                          |
|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| <b>DIVIDE</b>                                                                                  |                                                                                |
| $\begin{array}{r} 3 \\ 24 \overline{)78} \\ \underline{72} \\ 6 \text{ remainder} \end{array}$ | $\begin{array}{r} 24 \\ \times 3 \\ \hline 72 \\ + 6 \\ \hline 78 \end{array}$ |

2. What did Ann do to show that her quotient was correct? What did she do with the left-over part when she checked?

You will find division with two-place divisors easier if you remember the steps you take as you find each quotient figure.

**STEP ONE:** Divide.

The trial divisor is 2 and the trial dividend is 7. Think:  $2 \overline{)7}$ . Write the quotient figure 3 above the 8 of 78, for you are really dividing 78 by 24.

**STEP TWO:** Multiply.

Think: 3 times 24 is 72. Write 72 under 78.

**STEP THREE:** Compare.

To test if the quotient figure, 3, is too large, compare 72 with 78. Since 72 is not greater than 78, the quotient figure is not too large.

**STEP FOUR:** Subtract.

Subtract 72 from 78. The remainder is 6.

**STEP FIVE:** Compare.

Compare the remainder with the divisor. Since the remainder, 6, is less than the divisor, 24, the quotient is not too small.

$$\begin{array}{r} 3 \\ 24 \overline{)78} \end{array}$$

$$\begin{array}{r} 3 \\ 24 \overline{)78} \\ \underline{72} \end{array}$$

$$\begin{array}{r} 3 \\ 24 \overline{)78} \\ \underline{72} \end{array}$$

$$\begin{array}{r} 3 \\ 24 \overline{)78} \\ \underline{-72} \\ 6 \end{array}$$

$$\begin{array}{r} 3 \\ 24 \overline{)78} \\ \underline{72} \\ 6 \end{array}$$

### Practice with Two-Place Divisors

► Copy. Find the quotients. If there is a left-over part, write it as a remainder. Check your answers.

1.  $50 \overline{)450}$      $40 \overline{)320}$      $60 \overline{)720}$

2.  $73 \overline{)438}$      $63 \overline{)252}$      $21 \overline{)147}$

3.  $94 \overline{)188}$      $83 \overline{)581}$      $56 \overline{)280}$

4.  $55 \overline{)330}$      $95 \overline{)380}$      $57 \overline{)228}$

5.  $86 \overline{)430}$      $66 \overline{)264}$      $87 \overline{)261}$

6.  $48 \overline{)197}$      $78 \overline{)245}$      $88 \overline{)559}$

7.  $98 \overline{)305}$      $79 \overline{)332}$      $93 \overline{)678}$

8.  $78 \overline{)175}$      $55 \overline{)149}$      $77 \overline{)695}$

Remember these checks for division.

■ If there is no remainder, check by multiplying the quotient by the divisor. The product should be the same as the dividend in your division.

■ If there is a remainder, check by multiplying the quotient by the divisor. Add the remainder to the product.

### A New Step with Two-Place Divisors

Bill and Jerry were pupil helpers. They had some problems with two-place divisors.

1. Bill had to find out how many books to give each class. There were 740 books to be divided and 32 classes to get them. Bill wrote the division for his problem.

BILL

$$\begin{array}{r}
 23, r 4 \\
 32 \overline{)740} \\
 \underline{-64} \phantom{0} \\
 100 \\
 \underline{-96} \\
 4
 \end{array}$$

Study Bill's work and explain why the new step is called **Bring Down**.

2. Explain how Bill used these steps.

STEP ONE: Divide

STEP TWO: Multiply

STEP THREE: Compare

STEP FOUR: Subtract

STEP FIVE: Compare

STEP SIX: Bring Down

3. What steps did Bill repeat after the "bring down" step?



4. Jerry had to find out how many pencils each class would receive if 7426 pencils were divided among 32 classes. Study his division. How is it different from Bill's?

$$\begin{array}{r}
 232, r 2 \\
 32 \overline{) 7426} \\
 \underline{64} \phantom{00} \\
 102 \phantom{00} \\
 \underline{96} \phantom{00} \\
 66 \phantom{00} \\
 \underline{64} \phantom{00} \\
 2
 \end{array}$$

JERRY

5. How many "bring down" steps did Jerry have in his division? What steps did he repeat after each "bring down" step?

► Copy. Divide. Think of each step as you work. Check your answers.

6.  $22 \overline{) 902}$      $32 \overline{) 992}$      $42 \overline{) 966}$

7.  $73 \overline{) 1679}$      $83 \overline{) 2573}$      $93 \overline{) 3906}$

8.  $34 \overline{) 782}$      $44 \overline{) 1364}$      $54 \overline{) 4482}$

9.  $28 \overline{) 5936}$      $38 \overline{) 11894}$      $48 \overline{) 15552}$

10.  $68 \overline{) 23256}$      $78 \overline{) 26910}$      $88 \overline{) 54000}$

11.  $39 \overline{) 8307}$      $49 \overline{) 10927}$      $59 \overline{) 24485}$

12.  $79 \overline{) 41396}$      $89 \overline{) 45657}$      $89 \overline{) 55625}$

13.  $56 \overline{) 19152}$      $96 \overline{) 52416}$      $97 \overline{) 70295}$

14.  $58 \overline{) 23896}$      $98 \overline{) 42728}$      $69 \overline{) 29325}$

15. There were 800 children's tickets for a school entertainment. Divide these so that each of 24 classes gets an equal number of tickets. How many will each class get? How many will be left over?

16. Divide 800 adult tickets so that 61 parents will each get an equal number. How many tickets will each parent get? How many will be left over?

17. Divide 3500 handbills evenly among 28 Boy Scouts. How many will each receive?

#### Keeping in Practice

► Copy. Find the answers.

|               |               |                |                |
|---------------|---------------|----------------|----------------|
| 1. 5628       | 4758          | \$45.01        | \$5.28         |
| 6892          | 1528          | 98.25          | 14.37          |
| 4008          | 792           | 51.24          | .75            |
| 8562          | 45            | 36.09          | 1.00           |
| <u>+ 2315</u> | <u>+ 7923</u> | <u>+ 24.10</u> | <u>+ 11.85</u> |

|               |                |              |             |
|---------------|----------------|--------------|-------------|
| 2. 6258       | 53970          | 8390         | 870000      |
| <u>- 6208</u> | <u>- 21984</u> | <u>- 989</u> | <u>- 25</u> |

|              |              |            |             |
|--------------|--------------|------------|-------------|
| 3. 489       | 500          | \$25.75    | \$85.35     |
| <u>× 504</u> | <u>× 168</u> | <u>× 6</u> | <u>× 72</u> |

4.  $67 \overline{) 35644}$      $36 \overline{) 14862}$      $47 \overline{) 15928}$

5.  $96 \overline{) 52416}$      $86 \overline{) 37496}$      $46 \overline{) 19366}$

|       |                      |                      |                      |                      |                      |
|-------|----------------------|----------------------|----------------------|----------------------|----------------------|
| CAROL | TOO LARGE            | TOO LARGE            | TOO LARGE            | NOT TOO LARGE        | NOT TOO SMALL        |
|       | 7                    | 6                    | 5                    | 4                    | 4                    |
|       | $29 \overline{)141}$ | $29 \overline{)141}$ | $29 \overline{)141}$ | $29 \overline{)141}$ | $29 \overline{)141}$ |
|       | -203                 | -174                 | -145                 | -116                 | -116                 |
|       |                      |                      |                      |                      | 25                   |

### Finding the Correct Quotient Figure

Carol said, "When I divided 141 by 29, I had to use four trial quotient figures before I found the right quotient figure."

1. Look at the work at the top of the page. How did Carol know that the quotient figure 7 was too large? What did she do to find that the quotient figures 6 and 5 were also too large?

2. What did Carol do to her trial divisor each time she found that her trial quotient figure was too large?

3. In what two ways did Carol compare to be sure that her trial quotient figure was not too large or too small?

Tom said he had to erase too much if he kept decreasing his trial quotient by 1 each time his quotient figure was too large. He said he estimated in this way:

"In dividing 194 by 29, I can see that the quotient figure 9 is much too large. I skip 9 and 8 and try 7 as the trial quotient figure."

When I find 7 is too large, I try 6."

|                      |                             |
|----------------------|-----------------------------|
| TOM                  | ESTIMATE                    |
| 9                    | 8                           |
| $29 \overline{)194}$ | $29 \overline{)194}$        |
|                      |                             |
| WRITE                |                             |
| TOO LARGE            | NOT TOO LARGE NOT TOO SMALL |
| 7                    | 6                           |
| $29 \overline{)194}$ | $29 \overline{)194}$        |
| -203                 | -174                        |
|                      | -174                        |
|                      | 20                          |

4. Explain how Tom could estimate that the quotient figure 9 was much too large.

5. What would you think to estimate that the quotient figure 8 was too large?

► Copy. Find the quotients.

6.  $49 \overline{)322}$      $59 \overline{)367}$      $39 \overline{)243}$

7.  $38 \overline{)211}$      $68 \overline{)482}$      $88 \overline{)723}$

8.  $29 \overline{)2262}$      $69 \overline{)5658}$      $58 \overline{)5684}$

9.  $78 \overline{)5694}$      $57 \overline{)3762}$      $86 \overline{)6536}$

10.  $57 \overline{)5073}$      $68 \overline{)5168}$      $78 \overline{)6396}$



## Dollars and Cents in Division

1. A group of 64 children are going to have a picnic. They spent \$5.76 for prizes. How much must each child pay to cover the cost of these prizes?

Which child found the answer in the shortest way?

|                              |                         |         |
|------------------------------|-------------------------|---------|
| $\$5.76 = 576\text{¢}$       |                         | ANN     |
| JOE                          | 9¢                      | $\$.09$ |
| $64 \overline{)576\text{¢}}$ | $64 \overline{)\$5.76}$ |         |
| $\underline{-576}$           | $\underline{-576}$      |         |

2. How did Ann show that her answer was 9¢ and not \$9.

3. How did she know where to place the decimal point in her quotient?

■ In dividing dollars and cents by a whole number, place the decimal point in the quotient **directly above** the decimal point in the dividend.

4. A druggist paid \$172.80 for 72 bottles of perfume. How much did he pay per bottle?

|                           |                    |
|---------------------------|--------------------|
| $\$2.40$                  |                    |
| $72 \overline{)\$172.80}$ | $\underline{-144}$ |
| JOAN                      | $\underline{-288}$ |
|                           | $\underline{-288}$ |
|                           | 0                  |

Explain how Joan found each quotient figure.

■ After the first quotient figure is found, a quotient figure must be shown for **each** dividend figure that we bring down.

5. Explain how each quotient figure was found in these examples.

|                                                                                                             |                                                                                                                                                                                                                    |                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>A.</p> $\begin{array}{r} 400 \\ 38 \overline{)15200} \\ \underline{-152} \phantom{00} \\ 00 \end{array}$ | <p>B.</p> $\begin{array}{r} 208 \\ 73 \overline{)15184} \\ \underline{-146} \phantom{00} \\ 58 \phantom{00} \\ \underline{-00} \phantom{00} \\ 584 \phantom{00} \\ \underline{-584} \phantom{00} \\ 0 \end{array}$ | <p>C.</p> $\begin{array}{r} \$40.70 \\ 48 \overline{)\$1953.60} \\ \underline{-192} \phantom{00} \\ 33 \phantom{00} \\ \underline{-00} \phantom{00} \\ 336 \phantom{00} \\ \underline{-336} \phantom{00} \\ 0 \end{array}$ |
|-------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

► Copy. Find quotients. Check.

- |                            |                        |                        |
|----------------------------|------------------------|------------------------|
| 6. $74 \overline{)2220}$   | 87 $\overline{)4350}$  | 92 $\overline{)3680}$  |
| 7. $75 \overline{)5275}$   | 83 $\overline{)7498}$  | 98 $\overline{)2112}$  |
| 8. $57 \overline{)19248}$  | 63 $\overline{)30249}$ | 78 $\overline{)31226}$ |
| 9. $34 \overline{)10438}$  | 43 $\overline{)17458}$ | 92 $\overline{)64492}$ |
| 10. $67 \overline{)34103}$ | 45 $\overline{)27090}$ | 28 $\overline{)25284}$ |
| 11. $61 \overline{)30744}$ | 45 $\overline{)40725}$ | 32 $\overline{)19424}$ |

## Taking Stock — Test 2



This test will help you to find out how well you can add, subtract, multiply, and divide. From your score you can tell how much improvement you have made since the first "Taking Stock" test.

For Parts I and II use folded paper. Write the sums and the differences. For Parts III and IV copy the examples and find the answers.

Your teacher will tell you when to start and when to stop.

### PART I ADDITION

- |    |                                                                    |                                                                    |                                                                    |
|----|--------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------|
| 1. | $\begin{array}{r} 345 \\ 277 \\ 618 \\ +104 \\ \hline \end{array}$ | $\begin{array}{r} 578 \\ 105 \\ 993 \\ +891 \\ \hline \end{array}$ | $\begin{array}{r} 196 \\ 475 \\ 866 \\ +342 \\ \hline \end{array}$ |
| 2. | $\begin{array}{r} 476 \\ 643 \\ 600 \\ +198 \\ \hline \end{array}$ | $\begin{array}{r} 780 \\ 118 \\ 674 \\ +644 \\ \hline \end{array}$ | $\begin{array}{r} 101 \\ 914 \\ 823 \\ +783 \\ \hline \end{array}$ |
| 3. | $\begin{array}{r} 524 \\ 476 \\ 174 \\ +854 \\ \hline \end{array}$ | $\begin{array}{r} 895 \\ 586 \\ 817 \\ +532 \\ \hline \end{array}$ | $\begin{array}{r} 708 \\ 932 \\ 814 \\ +105 \\ \hline \end{array}$ |

### PART II SUBTRACTION

- |    |                                                     |                                                     |                                                      |
|----|-----------------------------------------------------|-----------------------------------------------------|------------------------------------------------------|
| 4. | $\begin{array}{r} 567 \\ -94 \\ \hline \end{array}$ | $\begin{array}{r} 286 \\ -95 \\ \hline \end{array}$ | $\begin{array}{r} 945 \\ -208 \\ \hline \end{array}$ |
|----|-----------------------------------------------------|-----------------------------------------------------|------------------------------------------------------|

|    |                                                       |                                                       |                                                        |
|----|-------------------------------------------------------|-------------------------------------------------------|--------------------------------------------------------|
| 5. | $\begin{array}{r} 1783 \\ -875 \\ \hline \end{array}$ | $\begin{array}{r} 2467 \\ -924 \\ \hline \end{array}$ | $\begin{array}{r} 8170 \\ -2365 \\ \hline \end{array}$ |
|----|-------------------------------------------------------|-------------------------------------------------------|--------------------------------------------------------|

|    |                                                        |                                                        |                                                        |
|----|--------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------|
| 6. | $\begin{array}{r} 1985 \\ -1622 \\ \hline \end{array}$ | $\begin{array}{r} 7089 \\ -5497 \\ \hline \end{array}$ | $\begin{array}{r} 8462 \\ -6997 \\ \hline \end{array}$ |
|----|--------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------|

### PART III MULTIPLICATION

|    |                                                          |                                                          |                                                          |
|----|----------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|
| 7. | $\begin{array}{r} 98 \\ \times 16 \\ \hline \end{array}$ | $\begin{array}{r} 65 \\ \times 64 \\ \hline \end{array}$ | $\begin{array}{r} 65 \\ \times 24 \\ \hline \end{array}$ |
|----|----------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|

|    |                                                            |                                                            |                                                            |
|----|------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|
| 8. | $\begin{array}{r} 307 \\ \times 259 \\ \hline \end{array}$ | $\begin{array}{r} 600 \\ \times 128 \\ \hline \end{array}$ | $\begin{array}{r} 578 \\ \times 402 \\ \hline \end{array}$ |
|----|------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|

|    |                                                            |                                                            |                                                            |
|----|------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|
| 9. | $\begin{array}{r} 329 \\ \times 500 \\ \hline \end{array}$ | $\begin{array}{r} 590 \\ \times 320 \\ \hline \end{array}$ | $\begin{array}{r} 534 \\ \times 908 \\ \hline \end{array}$ |
|----|------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|

### PART IV DIVISION

|     |                     |                      |                      |
|-----|---------------------|----------------------|----------------------|
| 10. | $8 \overline{)672}$ | $6 \overline{)5700}$ | $9 \overline{)7740}$ |
|-----|---------------------|----------------------|----------------------|

|     |                       |                       |                        |
|-----|-----------------------|-----------------------|------------------------|
| 11. | $48 \overline{)5868}$ | $32 \overline{)9536}$ | $67 \overline{)47436}$ |
|-----|-----------------------|-----------------------|------------------------|

|     |                        |                      |                        |
|-----|------------------------|----------------------|------------------------|
| 12. | $96 \overline{)48768}$ | $18 \overline{)900}$ | $68 \overline{)34544}$ |
|-----|------------------------|----------------------|------------------------|

|     |                        |                        |
|-----|------------------------|------------------------|
| 13. | $84 \overline{)43848}$ | $73 \overline{)38033}$ |
|-----|------------------------|------------------------|

Check your answers with the right ones. Write your score at the top of your paper.

Take out your record sheet for the "Taking Stock" tests. In the column for Test 2, color or shade as many spaces as equal your score for this test.



## What Average Means

HOT... 80° AND ABOVE  
MILD... 68°-79°  
COOL... 55°-67°

The TV weather reporter said, "The weather along the East Coast was hot today."

Ann said, "How can he say that when the weather map showed that New York had a temperature of only 73 degrees?"

Jim said, "He did not mean that the temperature was hot at each place. He meant that the **average** temperature was hot. That is, he thought of the temperatures as if they were made even. Then he used that 'evened-up' number as the average. Since the average was 81°, he said the temperature was hot."

1. Explain how Jim "evened-up" the three temperatures.

| MIAMI | NEW YORK | WASHINGTON |
|-------|----------|------------|
| 88°   | 73°      | 82°        |
| -7°   | +1°      | -1°        |
| 81°   | 74°      | 81°        |
|       | +7°      |            |
| JIM   | 81°      |            |

2. Does Jim's explanation give a good idea of what average is? How



else can you tell what average means?

3. Bob showed Ann a short way to find the average. After he found the total number of degrees, he divided by 3. Why?

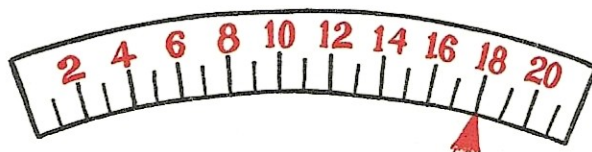
|     |     |                   |
|-----|-----|-------------------|
| BOB | 88  | 81 <b>average</b> |
|     | 73  |                   |
|     | +82 |                   |
|     | 243 |                   |
|     |     | 3 ) 243           |
|     |     | 24                |
|     |     | 3                 |
|     |     | 3                 |

4. Use Bob's way to find the average of all the temperatures given on the map above. How many temperature readings will you add? By what number will you divide?

5. Joe said he was a better fisherman than Tom. In 4 days Joe caught 6, 9, 5, and 4 fish. In 3 days Tom caught 8, 10, and 6 fish. Which boy had the better average?

6. Mr. Ames drove 325 miles on Monday, 500 miles on Tuesday, and 249 miles on Wednesday. How many miles did he average per day?

## How Well Have You Learned?



1. What number is 3 times as large as 59?
2. How many hundreds are equal to  $40 \times 40$ ?
3. How can you tell that the product of  $30 \times 4$  is half as large as the product of  $30 \times 8$ ?
4. How many thousands are equal to  $80 \times 50$ ?
5. When you count by 8's, what is the next number after 216?
6. When you count by 13's, what is the next number after 65?
7. When you multiply 248 by 452, how many partial products will there be?
8. When you multiply 250 by 321, what is the first partial product?
9. When you multiply 158 by 120, what is your first partial product?
10. Multiply 345 by 360.
11. Multiply 693 by 502.
12. Double 43.
13. Which of these are odd numbers? 56 17 25 39 54 86
14. How can you tell when a number is an even number?
15. What is the trial dividend when you are trying to find the first quotient figure in the example  $45 \overline{)180}$ ?
16. Jim began this division. What will be his next step?

| JIM                                                                                                     | SUE                                                                                                                  |
|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| $\begin{array}{r} 5 \\ 64 \overline{)3264} \\ \underline{320} \phantom{0} \\ 6 \phantom{0} \end{array}$ | $\begin{array}{r} 2 \\ 73 \overline{)15184} \\ \underline{146} \phantom{0} \downarrow \\ 58 \phantom{0} \end{array}$ |

17. In the example above, Sue brought down the 8 to make 58. She found that the divisor 73 was larger than 58. What figure should she write in the quotient?

Copy and finish Sue's division example.

18. There were 2880 sheets of paper, and 24 sheets were put in each box. How many boxes were used?

19. If one bushel of apples weighs about 50 pounds, about how many pounds will 120 bushels weigh?

20. Mr. Smith earns \$450 a month. He pays  $\frac{1}{5}$  of his salary for rent each month. How much rent does he pay each month?



### Help Yourself to Improve

1. Say the rule for multiplying any number by 1. (33) By 0. (33) By 10. (36)

2. Multiply 639 by 859. Check your product by interchanging the places of the multiplicand and multiplier and multiplying again. (30)

Write products on folded paper. If you cannot do this quickly and correctly, study pages 32 and 323.

$$\begin{array}{r} 3. \quad 9 \quad 6 \quad 8 \quad 7 \quad 3 \quad 9 \\ \times 5 \quad \times 8 \quad \times 7 \quad \times 9 \quad \times 8 \quad \times 4 \end{array}$$

$$\begin{array}{r} 4. \quad 8 \quad 6 \quad 9 \quad 7 \quad 5 \quad 8 \\ \times 9 \quad \times 7 \quad \times 3 \quad \times 7 \quad \times 8 \quad \times 8 \end{array}$$

Find the products. Use the method shown in the box. (31)

|                                                          |                                                          |                                                         |                                                       |
|----------------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------|
| $\begin{array}{r} 42 \\ \times 23 \\ \hline \end{array}$ | $\begin{array}{r} 42 \\ \times 20 \\ \hline \end{array}$ | $\begin{array}{r} 42 \\ \times 3 \\ \hline \end{array}$ | $\begin{array}{r} 840 \\ + 126 \\ \hline \end{array}$ |
| 8                                                        | 840                                                      | 126                                                     | 966                                                   |

$$\begin{array}{r} 5. \quad 69 \quad 72 \quad 44 \quad 68 \\ \times 23 \quad \times 14 \quad \times 32 \quad \times 13 \end{array}$$

Find the products. Check.

$$\begin{array}{r} 6. \quad 148 \quad (38) \quad 569 \quad (39) \\ \times 872 \quad \times 800 \end{array}$$

$$\begin{array}{r} 7. \quad 3030 \quad (40) \quad 3800 \quad (40) \\ \times 53 \quad \times 512 \end{array}$$

$$\begin{array}{r} 8. \quad \$65.50 \quad (41) \\ \times 25 \end{array}$$

$$\begin{array}{r} 15 \quad (42) \\ \times 7328 \end{array}$$

$$\begin{array}{r} 9. \quad 584 \quad (39) \\ \times 207 \end{array}$$

$$\begin{array}{r} 286 \quad (39) \\ \times 103 \end{array}$$

10. Copy. Draw a ring around the error in each example. Then do each division correctly.

(49)

(53)

|                                                                                                                                                                                                                   |                                                                                                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| A.                                                                                                                                                                                                                | B.                                                                                                           |
| $\begin{array}{r} 204 \\ 26 \overline{) 5239} \\ \underline{52} \phantom{00} \\ 12 \phantom{00} \\ \underline{00} \phantom{00} \\ 129 \phantom{00} \\ \underline{104} \phantom{00} \\ 4 \phantom{00} \end{array}$ | $\begin{array}{r} 3 \\ 62 \overline{) 2548} \\ \underline{186} \phantom{00} \\ 688 \phantom{00} \end{array}$ |

11. What quotient figure do you write when the divisor is larger than the dividend figure? (53)

12. Divide 105,000 by 35. (53)

13. Divide \$17.50 by 25. (53)

14. What do you do when you find that your trial divisor is larger than your first dividend figure? (48)

15. What do you do when you find that your trial quotient figure is too large? (52)

### Show That You Know

Try to find each answer without using a pencil. Then use a pencil to write the answer.

#### ADDITION

1. How much are  $63 + 31$ ?
2. How many 10's are equal to the sum of  $42 + 38$ ?
3. What is the sum of 47 and 41?
4. How many 100's are equal to the sum of  $170 + 430$ ?
5. What number when added to itself makes 90?
6. How much are  $91 + 33$ ?
7. What number when added to 75 makes 125?
8. What number is 36 more than 50?

#### SUBTRACTION

9. What number is 51 less than 95?
10. What is the difference between 195 and 170?
11. Subtract 142 from 344. What is the difference?
12. How many 10's less than 87 is 27?
13. What number is 250 less than 1000?

14. Subtract 47 from 400. What is the difference?

15. When 52 is subtracted from a number, the difference is 52. What is the number?

16. How much is 270 less 90?

#### MULTIPLICATION

17. How many are five 19's?
18. How many 100's are equal to  $40 \times 60$ ?
19. What number is twice 123?
20. How many are five 13's?
21. How many 10's are equal to  $30 \times 20$ ?
22. How many are three 200's?
23. What number multiplied by itself equals 81?

#### DIVISION

24. How many 20's are equal to 180?
25. What number is left over when you divide 83 by 9?
26. How many 35's equal 105?
27. What is the quotient of  $236 \div 236$ ?
28. How many 200's equal 4000?
29. When 106 is divided by 25, what number is left over?





| STATE        | TOTAL AREA     | WATER AREA    |
|--------------|----------------|---------------|
| Delaware     | 2,407 sq. mi.  | 429 sq. mi.   |
| Rhode Island | 1,228 sq. mi.  | 170 sq. mi.   |
| Connecticut  | 5,009 sq. mi.  | 110 sq. mi.   |
| New York     | 53,952 sq. mi. | 6,023 sq. mi. |
| Minnesota    | 84,068 sq. mi. | 4,059 sq. mi. |

### Using Fractions in Comparing Amounts

Alice made the chart above from facts she found in an atlas. The teacher asked, "About what part of the area of Delaware is water?"

1. Bob thought that the water area was about  $\frac{1}{6}$  of the total area. Alice thought  $\frac{1}{5}$  would be a better estimate. Whose estimating was better? You can find out by finding  $\frac{1}{5}$  of 2407 and  $\frac{1}{6}$  of 2407.

2. Bob said, "I thought this way to get my answer: The water area is  $\frac{429}{2407}$  of the total area. I rounded 429 to 400 and 2407 to 2400. Six 400's = 2400. That would show that the water part is  $\frac{1}{6}$  of the total." Why is  $\frac{1}{5}$  a better fraction to use than  $\frac{429}{2407}$ ?

3. Alice also rounded the numerator and the denominator in  $\frac{429}{2407}$ . To what numbers did she round 429 and 2407 to get  $\frac{1}{5}$ ? What is wrong with rounding this way?

4. What part of total area is

water area in Rhode Island? Connecticut? New York? Minnesota?

5. You can say that the area of Rhode Island is about 1200 sq. mi. and that the area of Delaware is about 2400 sq. mi. How were these numbers rounded? The area of Rhode Island is about what fraction of the area of Delaware?

Think in a like way and make a similar statement for each of these pairs of states.

|                           |                |
|---------------------------|----------------|
| { Delaware . . . . .      | 2,400 sq. mi.  |
| { Vermont . . . . .       | 9,600 sq. mi.  |
| { Maryland . . . . .      | 11,000 sq. mi. |
| { Maine . . . . .         | 33,000 sq. mi. |
| { Connecticut . . . . .   | 5,000 sq. mi.  |
| { Massachusetts . . . . . | 8,000 sq. mi.  |
| { West Virginia . . . . . | 24,000 sq. mi. |
| { Kentucky . . . . .      | 40,000 sq. mi. |

6. Joe lives in a city of 10,000 people. Bill lives in a town of 2000. Give a fraction that will compare the size of the two places.

## Facts About Fractions

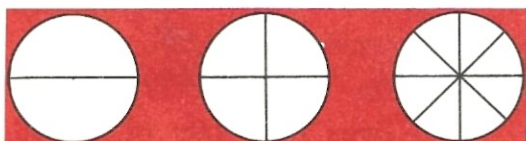
The teacher said, "When we used fractions in comparing quantities on page 59, some pupils spoke of the number above the line in a fraction and the number below the line. What are the correct names for the **terms** of a fraction?"

Jim said, "The terms of a fraction are the numerator and the denominator. The **numerator** is the number above the line. It tells how many parts there are in the fraction. The **denominator** is the number below the line. It tells the size of the parts."

1. The fraction  $\frac{2}{3}$  shows that the whole has been divided into how many parts? How many of these parts does the fraction stand for? How can you tell?



Ann said, "If the denominator is small, the whole is not divided into many parts. I'll fold this paper circle to show you what I mean."



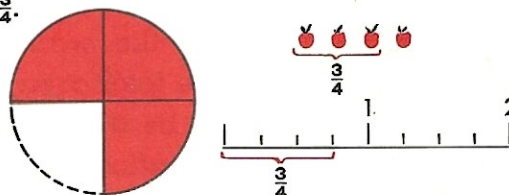
2. Fold a sheet of paper into 3 sections. What is each section called? Fold the same sheet into

6 sections. What is each section called? Fold the same sheet into 12 sections. What is each section called? As the denominator gets larger, what happens to the size of the sections?

3. If  $\frac{1}{2}$  means 1 of 2 equal parts, what does each of these fractions mean?

$$\frac{1}{8} \quad \frac{1}{5} \quad \frac{5}{6} \quad \frac{4}{9} \quad \frac{1}{12} \quad \frac{3}{4}$$

Jack made these drawings to show  $\frac{3}{4}$ .

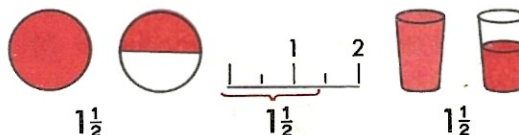


4. Make a drawing to show each of these fractions.

$$\frac{1}{5} \quad \frac{2}{7} \quad \frac{3}{8} \quad \frac{1}{10} \quad \frac{5}{6} \quad \frac{4}{9}$$

Bill said, "How would you make a drawing of a mixed number?"

5. Mary thought, "A mixed number is a whole number and a fraction, like  $1\frac{1}{2}$ ." Then she made these drawings. Are they correct?



6. Make drawings to show:

$$2\frac{1}{4} \quad 3\frac{2}{3} \quad 1\frac{4}{5} \quad 2\frac{6}{7} \quad 1\frac{1}{6}$$



## A Quick Fraction Review

1. Look at the measurements below. Which is longest? Use your ruler and draw lines to prove your answer.

$$\frac{1}{3} \text{ ft.} \quad \frac{1}{12} \text{ ft.} \quad \frac{1}{4} \text{ ft.} \quad \frac{1}{6} \text{ ft.}$$

2. How can you tell which is the longest measurement in problem 1 by just looking at the given fractions? How can you tell that  $\frac{1}{12}$  ft. is shorter than  $\frac{1}{6}$  ft.? How can you tell that  $\frac{1}{4}$  ft. is longer than  $\frac{1}{6}$  ft.?

3. The teacher wrote these fractions on the board. Which fraction equals a whole? Which fractions are equal to more than a whole? Which fractions are less than a whole? Make drawings to show that your answers are correct.

$$\frac{1}{3} \quad \frac{5}{4} \quad \frac{6}{6} \quad \frac{3}{2} \quad \frac{5}{7}$$

4. How could you tell without a drawing which fraction in problem 3 equals a whole? How can you tell which fractions equal more than a whole?

5. Look at these fractions. Which are less than a whole? How can you tell?

$$\frac{1}{2} \quad \frac{7}{8} \quad \frac{5}{6} \quad \frac{9}{6} \quad \frac{7}{12} \quad \frac{10}{10}$$

In the next column are some helpful things to remember about fractions.

■ A fraction means less than a whole if the numerator is smaller than the denominator. A fraction that means **less than a whole** is a **proper fraction**.

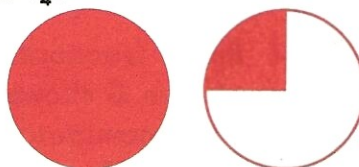
■ A fraction means 1 whole if the numerator and the denominator are **equal**.

■ A fraction means more than 1 whole if the numerator is larger than the denominator. Fractions meaning 1 whole or more than 1 whole are **improper fractions**.

6. A cake was cut into 8 equal pieces. Each of 5 children ate one piece. What part of the cake was eaten?

7. Study drawings A and B. Which drawing shows  $\frac{5}{4}$ ? Which shows  $1\frac{1}{4}$ ?

A.



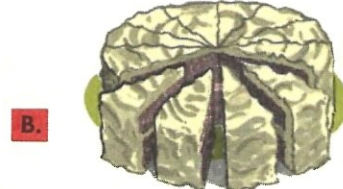
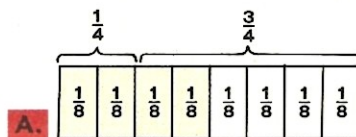
B.



Numbers like  $1\frac{1}{4}$ ,  $3\frac{1}{2}$ , and  $2\frac{5}{12}$  are mixed numbers.

■ A **mixed number** is a number made up of a whole number and a fraction.

## More About Fractions



Drawings A and B above will help you answer these questions.

1. How many eighths are there in one whole?

2. How many eighths in drawing A are colored? When you add  $\frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8}$ , which term of the fractions do you add — the numerators or denominators?

3. Which of these fractions are smaller than  $\frac{1}{2}$ ?

$$\frac{3}{8} \quad \frac{1}{4} \quad \frac{7}{8} \quad \frac{3}{4} \quad \frac{1}{8}$$

4. What part of the cake is left on the plate in drawing B?

Sue said, " $\frac{8}{12}$ ."

Bill said, " $\frac{4}{6}$ ."

Jim said, " $\frac{2}{3}$ ."

Which of these fractions tells exactly what picture B shows? Remember that the denominator of a fraction shows the number of equal parts into which the whole is divided.

Which child gave the fraction in simplest form, or in lowest terms?

5. Which of these fractions are not in simplest form, or lowest terms? Write them in lowest terms.

$$\frac{6}{12} \quad \frac{7}{12} \quad \frac{2}{8} \quad \frac{7}{8} \quad \frac{8}{12}$$

6. Draw three circles. Use them to show that  $\frac{2}{3}$ ,  $\frac{4}{6}$ , and  $\frac{8}{12}$  are equal fractions.

One class made these charts to show fractions of equal value. Study the charts.

**C.**

| ONE            |                |                |                |                |                |                |                |                |                |                |                |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| $\frac{1}{2}$  |                |                |                |                |                | $\frac{1}{2}$  |                |                |                |                |                |
| $\frac{1}{4}$  |                |                |                | $\frac{1}{4}$  |                | $\frac{1}{4}$  |                |                |                | $\frac{1}{4}$  |                |
| $\frac{1}{8}$  | $\frac{1}{8}$  | $\frac{1}{8}$  | $\frac{1}{8}$  | $\frac{1}{8}$  | $\frac{1}{8}$  | $\frac{1}{8}$  | $\frac{1}{8}$  | $\frac{1}{8}$  | $\frac{1}{8}$  | $\frac{1}{8}$  | $\frac{1}{8}$  |
| $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ |

**D.**

| ONE            |                |                |                |                |                |                |                |                |                |                |                |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| $\frac{1}{2}$  |                |                |                |                |                | $\frac{1}{2}$  |                |                |                |                |                |
| $\frac{1}{3}$  |                |                |                | $\frac{1}{3}$  |                | $\frac{1}{3}$  |                |                |                | $\frac{1}{3}$  |                |
| $\frac{1}{6}$  | $\frac{1}{6}$  | $\frac{1}{6}$  | $\frac{1}{6}$  | $\frac{1}{6}$  | $\frac{1}{6}$  | $\frac{1}{6}$  | $\frac{1}{6}$  | $\frac{1}{6}$  | $\frac{1}{6}$  | $\frac{1}{6}$  | $\frac{1}{6}$  |
| $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{12}$ |

Use charts C and D. Write the numbers that belong in place of the question marks below.

7.  $\frac{1}{2} = \frac{?}{12}$        $\frac{3}{4} = \frac{?}{8}$        $\frac{4}{6} = \frac{?}{3}$

8.  $\frac{8}{12} = \frac{?}{3}$        $\frac{1}{2} = \frac{?}{8}$        $\frac{3}{4} = \frac{?}{12}$

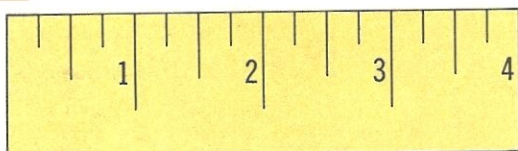
9.  $\frac{2}{12} = \frac{?}{6}$        $\frac{6}{8} = \frac{?}{4}$        $\frac{10}{12} = \frac{?}{6}$

10.  $\frac{1}{2} = \frac{?}{4} = \frac{?}{8}$        $\frac{4}{12} = \frac{?}{6} = \frac{?}{3}$

11. If you did not have charts C and D, how would you find the missing numerator in  $\frac{3}{12} = \frac{?}{4}$ ? In  $\frac{1}{2} = \frac{?}{6}$ ?



**E.**



12. The teacher asked the class to count by  $\frac{1}{4}$ 's to 2. Here is how two children counted.

Bob:  $\frac{1}{4}$   $\frac{1}{2}$   $\frac{3}{4}$  1  $1\frac{1}{4}$   $1\frac{1}{2}$   $1\frac{3}{4}$  2  
 Ann:  $\frac{1}{4}$   $\frac{2}{4}$   $\frac{3}{4}$   $\frac{4}{4}$   $\frac{5}{4}$   $\frac{6}{4}$   $\frac{7}{4}$   $\frac{8}{4}$

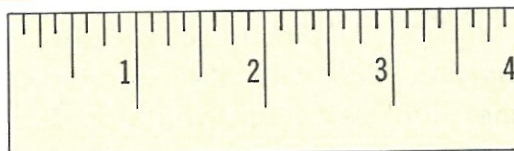
Use ruler E above to show that both counted correctly.

13. Use ruler E. Count by  $\frac{1}{2}$ 's to 4 in two ways.

14. Use ruler F. Count by  $\frac{3}{8}$ 's to  $1\frac{1}{2}$  in two ways.

15. Here are some of the additions that you thought as you

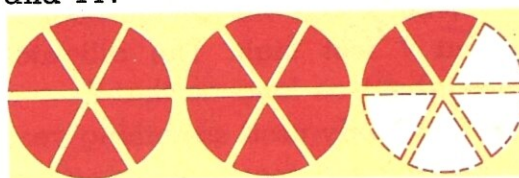
**F.**



counted by  $\frac{3}{8}$ 's. Copy. Find the sums. Write answers in lowest terms.

$$\begin{array}{r} \frac{3}{8} \\ + \frac{3}{8} \\ \hline \end{array} \quad \begin{array}{r} \frac{6}{8} \\ + \frac{3}{8} \\ \hline \end{array} \quad \begin{array}{r} \frac{9}{8} \\ + \frac{3}{8} \\ \hline \end{array}$$

Use these drawings to find the missing numerators in examples 16 and 17.



16.  $\frac{7}{6} = 1\frac{?}{6}$        $\frac{9}{6} = 1\frac{?}{6}$        $2\frac{1}{3} = \frac{?}{6}$

17.  $1\frac{2}{3} = \frac{?}{6}$        $\frac{11}{6} = 1\frac{?}{6}$        $\frac{3}{2} = 1\frac{?}{2}$

### Review of Things You Have Studied

1. Find and explain the error in each division example.

$$\begin{array}{r} 206 \\ 26 \overline{) 5278} \\ \underline{52} \phantom{00} \\ 178 \phantom{00} \\ \underline{156} \phantom{00} \\ 22 \end{array} \quad \begin{array}{r} 24 \\ 6 \overline{) 1224} \\ \underline{12} \phantom{00} \\ 24 \phantom{00} \\ \underline{24} \phantom{00} \end{array} \quad \begin{array}{r} 25 \\ 43 \overline{) 920} \\ \underline{68} \phantom{00} \\ 240 \phantom{00} \\ \underline{215} \phantom{00} \\ 25 \end{array}$$

2. Explain the meaning of an average.

3. Explain the meaning of the terms of a fraction.

4. Find the products.

$$\begin{array}{r} 65 \\ \times 14 \\ \hline \end{array} \quad \begin{array}{r} 86 \\ \times 21 \\ \hline \end{array} \quad \begin{array}{r} 56 \\ \times 23 \\ \hline \end{array} \quad \begin{array}{r} 49 \\ \times 19 \\ \hline \end{array} \quad \begin{array}{r} 74 \\ \times 11 \\ \hline \end{array}$$

5. What quotient figure do you write when the divisor is larger than the dividend?

### Using Reference Measures

Judy had been on a trip to Florida. She told the class that she had seen an alligator that was 7 feet long.

"We could lay 7 foot rulers one after the other on the floor to show how long the alligator was," the teacher said, "but can't you find something in the room that will give an idea of the length of the alligator?"

"Well," said Judy, "the door is about 7 feet high. The alligator was about as long as that."

When Judy used something very familiar as a measure instead of using a measuring instrument, she was using a **reference measure**.

1. Think of some other reference measure Judy could have used in telling about the length of the alligator.

2. The speed of an early automobile was 10 miles an hour. Name a place that is about as far from where you live as the auto could travel in an hour. Use a reference measure to estimate how long an hour is.

3. Jack lived in Elmville, a city of about 25,000 people. He has just moved to a city of 100,000 people. He wants to write his friends in



Elmville and tell them about the city where he now lives. How could he give them a good idea of its size?

4. Use the size of your own or a nearby city and tell how you could use it to estimate the size of the city nearest it.

5. Jim said, "Our new gymnasium is pretty long. It is about 6 times as long as our classroom. Our classroom is about 30 feet long." Use Jim's reference measure and estimate the length of the gymnasium.

Jane says she finds it hard to estimate how long it takes to do things. Here are some good references she can use.

Counting to 60 slowly takes about 1 minute.

It takes about 10 minutes to walk 6 blocks.

6. What are some other references for time which you can use?



## Making Your Own Reference Measures



When Bob visited his cousin Ricky's farm, Ricky told him it was about a mile across the field to the schoolhouse. Bob said that in the city he knew it was a mile from his house to the river.

The two boys used different reference measures for a mile because they lived in different places. Each place has its own set of reference measures that the people who live there use.

For each measure below make a reference measure that you could use where you live.

1. One pound
2. Ten pounds
3. Fifty pounds
4. One hundred pounds
5. One acre
6. One mile
7. Ten miles
8. One hundred miles
9. Seventy-five feet
10. A city of 50,000

Find the area of your state. Use it as a reference measure to tell how large these places are.

11. Lake Michigan — About 22,000 sq. mi.
12. Kentucky — About 40,000 sq. mi.
13. Massachusetts — About 8,000 sq. mi.
14. Scotland — About 30,000 sq. mi.

Find the population of your state. Use it as a reference measure to give an idea, or estimate, of how many people live in these places.

15. Nevada — About 160,000 people
16. Oregon — About 1,500,000 people
17. Illinois — About 8,700,000 people
18. Union of South Africa — About 13,000,000 people
19. Australia — About 9,000,000 people.

## What Area Means



The teacher said, "Long ago men measured surfaces in different ways. One way was to measure the surface by counting the number of times a hand was needed to cover the surface. Use this way to find how large the surface of your desk is."

Ann said her desk surface was equal to the surface of 32 hands.

1. Measure your desk surface. It is as large as the surface of how many hands?

2. Joe said, "We could use a book to measure the surface of the desk." Measure the surface of your desk with a book. How many times is the book needed to cover the surface of the desk?

■ The surface of your desk or any surface is called the **area** of the object.

Measure the areas of different things by following these suggestions.

3. Use a sheet of notebook paper to find the area of a table top.

4. Use an eraser to cover the surface of the front cover of a large book. What is the area, or the number of times the eraser is needed to cover the surface?

5. Use your hand to find the area of a small bulletin board or the area of a picture.

Pam said, "The surface of the desk top stays the same, but the number of hands and the number of books needed to cover it are different."

The teacher said, "That is because the measures we used were different. You get different answers just as you would if you used inches or feet to tell how tall you are."

6. Measure your desk surface again. Compare the area when you measure with your hand with the area when you use a book as the measure.

Jack wanted to find the area of a bulletin board 4 ft. long and 3 ft. wide. He thought that using



hands or books would take too long, and he wanted to get a more exact measure. He thought, "It is 4 ft. long. I can put 4 pieces of paper 1 ft. long along the bottom. If the paper is 1 ft. wide, I can use 3 rows of paper to cover the

surface. Three rows of 4 papers equal 12 papers. The area is 12 papers."

7. Use 1 in. to represent 1 ft. Make a drawing of Jack's bulletin board. Show how it looked when covered with the papers Jack used.

### Proving Number Statements

A statement about how much metal expands can be proved by heating the metal. A number statement can be proved, too. It can be proved by using a different way to find the answer.

1. Explain how Tom proved his sum.

| TOM        |           |           |            |
|------------|-----------|-----------|------------|
|            | ones      | tens      |            |
| 36         | 6         | 3         |            |
| 45         | 5         | 4         |            |
| 72         | 2         | 7         |            |
| +63        | +3        | +6        | ADD 16     |
| <u>216</u> | <u>16</u> | <u>20</u> | <u>216</u> |

2. Use Tom's way to prove your sums.

|     |     |     |      |      |
|-----|-----|-----|------|------|
| 38  | 94  | 37  | 562  | 839  |
| 74  | 29  | 56  | 694  | 758  |
| 69  | 85  | 93  | 783  | 609  |
| +87 | +46 | +48 | +259 | +396 |

3. Bob proved that  $36 \times 42 = 1512$ . Can you explain his proof?

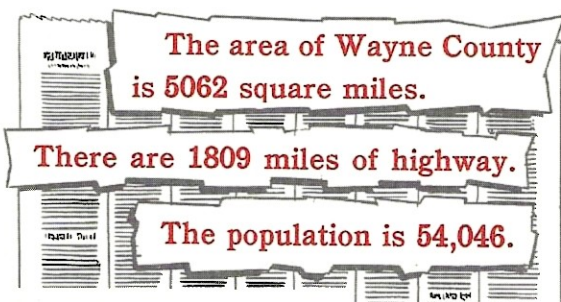
| BOB                           |                              |                              |             |
|-------------------------------|------------------------------|------------------------------|-------------|
| 42                            | 420                          | 42                           | 1260        |
| <u><math>\times 10</math></u> | <u><math>\times 3</math></u> | <u><math>\times 6</math></u> | <u>+252</u> |
| 420                           | 1260                         | 252                          | 1512        |

4. Find the products in the usual way. Use Bob's way to prove your answers.

|                               |                               |                               |                               |                               |
|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| 39                            | 78                            | 85                            | 425                           | 679                           |
| <u><math>\times 25</math></u> | <u><math>\times 31</math></u> | <u><math>\times 52</math></u> | <u><math>\times 43</math></u> | <u><math>\times 22</math></u> |

5. One of the proofs below is not correct. Find and explain the error.

|                               |                              |             |
|-------------------------------|------------------------------|-------------|
| A. $36 \times 36 = 468$       |                              |             |
| 36                            | 36                           | 144         |
| <u><math>\times 4</math></u>  | <u><math>\times 9</math></u> | <u>+324</u> |
| 144                           | 324                          | 468 ?       |
| B. $54 \times 24 = 1296$      |                              |             |
| 54                            | 648                          |             |
| <u><math>\times 12</math></u> | <u>+648</u>                  |             |
| 108                           | 1296                         | ?           |
| 54                            |                              |             |
| <u>648</u>                    |                              |             |



### Rounding Numbers

Tom reported some facts about Wayne County. He said, "The area of our county is about 5000 square miles. It has about 2000 miles of highway. The population is about 54,000."

1. Look at the clippings above. Why did Tom say "about" before giving each number?

2. Why did Tom round 5062 to 5000 and 1809 to 2000?

3. When rounding 54,046 to 54,000, Tom thought, "Any number between 54,000 and 54,499 is nearer to 54,000 than to 55,000." If Tom rounded 54,500 to the nearest thousand, would he say 55,000 or 54,000?

Round to the nearest thousand.

4. 4,812      7,399      9,500

5. 5,914      4,501      2,475

6. 35,203      86,741      32,499

7. Jim read, "One large buoy weighs 20,616 pounds." If Jim re-

ports this to the nearest thousand, what number will he use?

8. Sue read, "Yesterday 3212 persons attended the fair. Today 1561 attended." How many attended on both days? Round the sum to the nearest thousand. To the nearest hundred.

9. Ann read that a diesel locomotive weighs about 303,000 pounds, and a steam locomotive weighs about 351,400 pounds. How much more does the steam engine weigh? Round the difference to the nearest thousand. What would you find out if you tried to round the difference to the nearest hundred?

10. Don read about a truck costing \$2660. What is the cost rounded to the nearest hundred?

Round to the nearest hundred.

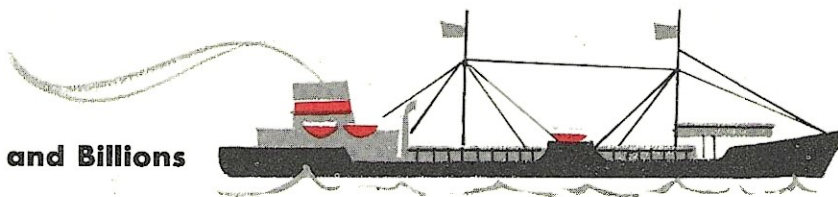
11. 4,672      7,850      1,028

12. 8,605      6,051      9,137

13. 16,890      27,940      14,849



## Rounding Millions and Billions



The boys and girls were comparing to see who had the news clipping with the largest number in it.

1. Mary said, "This says a large tanker holds 15,498,672 gallons of oil. That is a very large number. I will round it to 15,000,000 so that I can remember it better." Is a rounded number easier to remember?

2. Tom said, "This is a larger number. The total cost of a dam was \$86,519,350." What is this number rounded to the nearest million?

3. Bob said, "My number is the largest so far. A freight line hauled 166,667,055 lb. of freight." Is Bob's number closer to 166 or 167 million? What is his number rounded to the nearest million?

4. Can you give a rule for rounding a number to the nearest million?

Round to the nearest million.

5. 147,483,622      498,500,000

6. 259,690,106      386,342,068

7. 164,278,000      227,651,000

8. 345,943,060      558,800,000

9. Do you round large numbers when you try to remember them, or when you report them to someone? Can you think of some situations where it might not be wise to round numbers?

10. In one of our national forests it was estimated that there were 11,640,000 board feet of pine and 2,343,000 board feet of birch. What was the total estimate of pine and birch? Round the answer to the nearest million.

11. Nan read that in one year the United States spent \$2,646,400,884 on the navy. What is this number when rounded to the nearest billion?

12. Bob tried to round these numbers to the nearest billion. Which did he not do correctly?

a. 14,683,452,033 = 14 billion

b. 26,498,092,000 = 26 billion

c. 38,501,023,459 = 38 billion

d. 95,683,497,000 = 96 billion

e. 82,346,000,000 = 82 billion



## Checking Answers

Step One:

$$\begin{array}{r}
 60 \\
 \times 60 \\
 \hline
 3600 \\
 \times 24 \\
 \hline
 14400 \\
 7200 \\
 \hline
 86,400 \text{ seconds or} \\
 \$86,400 \text{ earned each day}
 \end{array}$$

Step Two:

$$\begin{array}{r}
 \$86,400 \\
 \times 365 \\
 \hline
 432000 \\
 518400 \\
 259200 \\
 \hline
 \$31,536,000 \text{ earned each year}
 \end{array}$$

Step Three:

$$\begin{array}{r}
 9354 \\
 \overline{) \$31,536,000} \overline{) \$295,000,000,000} \\
 \underline{283824} \\
 111760 \\
 \underline{94608} \\
 171520 \\
 \underline{157680} \\
 138400 \\
 \underline{126144} \\
 12256
 \end{array}$$

Answer: 9,354 years  
\$12,256 remainder

Jerry found a news clipping that said the national debt of the United States was about \$295,000,000,000. To give some idea of how much 295 billion dollars would be, Jerry's clipping said, "If you worked every second of every day, except the extra day in leap year, and earned \$1.00 every second that you worked, after 9354 years you would still have to earn \$12,256 to make \$295,000,000,000."

1. Jerry asked his father to show him how to find out if the facts in the clipping were right. Explain why each number given in color was used. Were the facts in the clipping correct?

2. Jerry could not do the difficult division in Step Three, but he did know how to check it. Explain Jerry's check on page 71 after you study the rule that he used.

### MEASURES OF TIME

- 60 seconds (sec.) = 1 minute (min.)
- 60 minutes = 1 hour (hr.)
- 24 hours = 1 day (da.)
- 7 days = 1 week (wk.)
- 365 days = 1 regular year
- 366 days = 1 leap year
- 52 wk. = 1 yr.
- 12 months (mo.) = 1 yr.



■ To check division with a remainder, you can multiply the quotient and divisor together and add the division remainder to your product.

|              |                                                                                                                                                                                                                                   |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | <b>CHECK</b>                                                                                                                                                                                                                      |
| <b>JERRY</b> | $  \begin{array}{r}  \$31,536 \\  \times 9354 \\  \hline  126144 \\  157680\phantom{0} \\  94608\phantom{00} \\  283824\phantom{000} \\  \hline  \$294,987,744 \\  +12,256\phantom{000} \\  \hline  \$295,000,000  \end{array}  $ |

3. Mary had a problem in which she divided 714 by 21. Did she check her division as Jerry did? Give the rule she used.

|                                                                                                                               |                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>MARY</b>                                                                                                                   | <b>CHECK</b>                                                                                                                  |
| $  \begin{array}{r}  34 \\  21 \overline{)714} \\  \underline{63} \phantom{0} \\  84 \\  \underline{84} \\  0  \end{array}  $ | $  \begin{array}{r}  21 \\  34 \overline{)714} \\  \underline{68} \phantom{0} \\  34 \\  \underline{34} \\  0  \end{array}  $ |

► Divide. Check in two ways.

4.  $13 \overline{)481}$      $23 \overline{)1297}$      $37 \overline{)1184}$

5.  $66 \overline{)1256}$      $29 \overline{)783}$      $46 \overline{)2665}$

6. Alice and Jack had a problem in which they had to multiply 58 by 49. Explain how Alice checked her multiplication. How did Jack find out if he multiplied correctly?

|                                                                                                           |                                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ALICE</b>                                                                                              | <b>CHECK</b>                                                                                                                                  |
| $  \begin{array}{r}  58 \\  \times 49 \\  \hline  522 \\  232\phantom{0} \\  \hline  2842  \end{array}  $ | $  \begin{array}{r}  58 \quad 2320 \\  \times 40 \quad +522 \\  \hline  522 \quad 2842 \\  2320 \phantom{00} \\  \hline  2842  \end{array}  $ |
| <b>JACK</b>                                                                                               | <b>CHECK</b>                                                                                                                                  |
| $  \begin{array}{r}  58 \\  \times 49 \\  \hline  522 \\  232\phantom{0} \\  \hline  2842  \end{array}  $ | $  \begin{array}{r}  58 \\  49 \overline{)2842} \\  \underline{245} \phantom{0} \\  392 \\  \underline{392} \\  0  \end{array}  $             |

► Copy. Find the products. Check the way you like better.

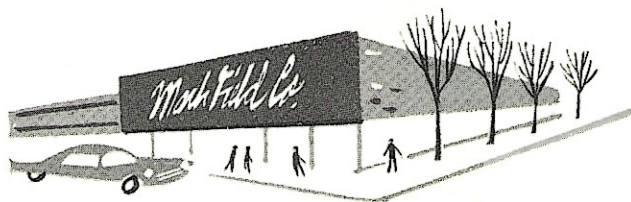
7.  $69 \times 18$      $87 \times 35$      $94 \times 21$      $55 \times 44$

8.  $48 \times 12$      $36 \times 32$      $82 \times 27$      $65 \times 43$

9.  $59 \times 14$      $86 \times 23$      $75 \times 11$      $97 \times 39$

10.  $43 \times 29$      $96 \times 36$      $64 \times 25$      $83 \times 13$

## Helps for Solving Problems



1. The sales of a large store were \$1,400,325 one year and \$2,526,435 the next year. The cost of running the store was \$1,300,125 the first year and \$1,665,232 the next. How much money did the store make in the two years, after the costs were paid?

Betty had trouble with this problem. She said, "I will think it through using small numbers in place of the large ones." She then made up problem 2, and thought how to solve it.

2. The sales of a store were \$1.00 the first year and \$2.00 the next. The cost of running the store was \$.50 the first year and \$.60 the next.

Subtract \$.50 from \$1.00 to find how much money the store made the first year.

Subtract \$.60 from \$2.00 to find how much money the store made the second year.

Add the differences to find how much the store made in two years. It made \$2.

3. Then Betty did problem 1. Her answer was \$961,403. Was her answer correct?

Think through problem 4 as Betty did, using small numbers instead of large numbers. Then solve problem 4.

4. A baseball park can seat a total of 55,550 people in the grandstand and bleachers. On one day 21,351 grandstand seats and 6,148 bleacher seats were sold. How many seats were vacant that day?

Jane had trouble with problems 5-7. She said each problem gave too many facts. For each of these problems think what facts are not needed. Then find the answer to the problem.

5. On a trip, Mary spent \$4.20 for food, \$25 for a suitcase, \$29.35 for airplane tickets, \$3.10 for taxis, and \$32.50 for clothes. How much did Mary spend for transportation?

6. The library received 10 boxes of books. There were 24 books in each box. Each book cost \$2.50. How many books did the library get?

7. Oranges cost 49¢ a dozen and lemons cost 10¢ more a dozen. Grapefruit cost 2 for 29¢. How much will  $\frac{1}{2}$  dozen lemons cost?



## Solving Problems

Write or say the number questions which will have to be answered to solve these problems.

1. How many feet of fence are needed to enclose a rectangular lot 210 ft. long and 60 ft. wide?

2. Socks were priced at 3 pairs for 98¢. How much did Jim pay for 6 pairs and for shoe polish which cost 39¢?

3. Some cattle were shipped in 29 freight cars. The total freight bill was \$7946. What was the cost per freight car?

The problems below use large numbers. Can you work with millions as easily as you work with tens? Find the answers.

4. A large group of fruit growers received 50 million dollars for oranges, 17 million for grapefruit, and 5 million for lemons. How many dollars was this in all?

5. A big company made 48 million dollars in one year. One department alone made 8 million dollars. What part of the total earnings did this one department make?

Three answers each are given below problems 6, 7, and 8. Choose

the most reasonable one. Then find the exact answer.

6. A certain type of dump truck holds 11 tons. In how many loads could it carry away 561 tons of earth?

40      30      50

7. There are about 650 pupils in Jill's school and half that number in Dick's school. How many pupils attend both schools?

900      700      400

8. The first Ferris wheel ever built could carry 2160 passengers in 36 cars. How many passengers could be seated in each car?

20      40      60

The table below tells at what height climbers built camps in the ascent of Mt. Everest in 1953. Use the table to make your own problems.

|        |            |
|--------|------------|
| Camp 1 | 18,000 ft. |
| Camp 2 | 19,000 ft. |
| Camp 3 | 20,500 ft. |
| Camp 4 | 22,000 ft. |
| Camp 5 | 22,630 ft. |
| Camp 6 | 25,740 ft. |
| Camp 7 | 25,850 ft. |
| Camp 8 | 27,800 ft. |
| Peak   | 29,028 ft. |



### Measuring Objects

1. Jean wanted to measure the space between the edge of the mural and the bulletin board. There was no ruler handy, but Jean did have a pencil. How could she measure the space by using the pencil?

2. Bob saw Jean measuring this space with her pencil. He said, "Once I used a stick to measure how far the ball was from the foul line." Explain how Bob could use a stick to measure that distance.

3. Ann said, "Sometimes I measure cloth by holding one end of it near my chin and stretching out my arm. This way I can measure from my chin to my finger tips. That much cloth is about one yard."

Measure a piece of string using Ann's way. Do you find it is about one yard from your chin to the finger tips of your outstretched hand?

4. Are these ways of measuring

really very different from using a standard measure?

5. Without using a standard measure, how could you find out if a door is wide enough before you try to move a piano through it?

6. The teacher said, "Often we measure by substituting a different object of the same size. Can we measure in any other ways?"

Jean said, "Well, your desk is twice as tall as the wastepaper basket." Find something in your classroom that is twice as tall as your desk.

7. Bob said, "I'll compare the filing cabinet and the door. The cabinet is half the height of the door." Find something in your classroom that is half the height of the door.

8. Give other examples of measuring something by comparing it with another object which is not the same size.



## Using Standard Measures



Some first-grade children were getting an aquarium ready for use. They asked the sixth-grade children to help them. The sixth-grade children decided that the aquarium would hold  $8\frac{1}{2}$  gallons of water after the sand was put in. They thought that a  $\frac{1}{2}$ -gallon bottle could be used to put the water into the aquarium.

1. One first-grader asked, "How many  $\frac{1}{2}$  gallons will it take to put  $8\frac{1}{2}$  gallons in the aquarium?" Can you answer this question?

2. Another first-grade child wanted to use a pint milk bottle to fill the aquarium. What do you think of this idea? How many pints equal  $8\frac{1}{2}$  gallons?

3. Which can will hold the most water, a 9-qt. can, an 18-pt. can, or a 2-gal. can?

4. If you missed any of the problems above, study the table of liquid measures on page 346.

5. To mark their 50-yd. track, some boys used red flags. They put the flags 10 ft. apart. How many flags did they need to mark both sides of the track if no flags

were put at the beginning of either side? A drawing can help you.

6. Which is longest, 70 in., 5 ft., or 2 yd.?

7. It takes 6 in. of ribbon to make a badge. How many yards of ribbon are needed to make 8 badges?

8. How many yards of fencing are needed to enclose a garden which is 45 ft. long and 30 ft. wide?

9. Which is shortest, 2 mi., 8000 ft., or 32 rd.?

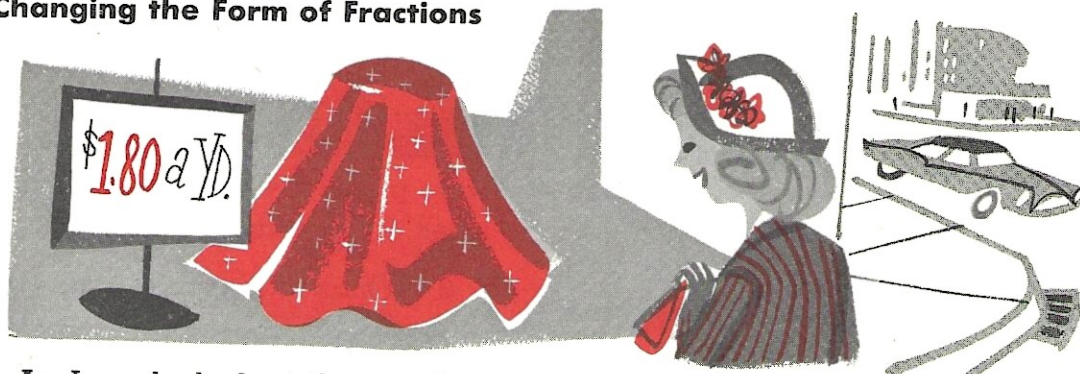
10. If you missed any problems from 5 through 9, refer to the table of measures of length on page 346.

11. If you measured how far you live from school, would you use feet, yards, city blocks, or miles? Why?

12. Would you use cups, quarts, pints, or gallons to measure the milk in a partly-filled milk can? Explain your answer.

13. What is the difference between a standard measure and a reference measure?

## Changing the Form of Fractions

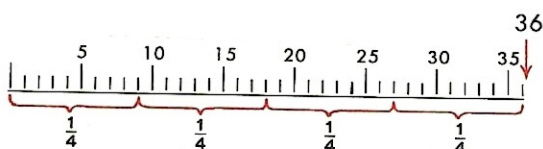


As Jean looked at the goods in the store window, she thought, "I need only 24 inches of that material. That would be  $\frac{24}{36}$  of a yard. How much would  $\frac{24}{36}$  of \$1.80 be?"

1. What would be the simplest way to say what part of a yard Jean needed?

2. If you bought  $\frac{3}{4}$  of a yard of material, would you get 27 inches of the material?

3. To check his answer for problem 2, Bob made this drawing. Does it show that 27 is  $\frac{3}{4}$  of 36?



Jim found his answer to problem 2 by changing  $\frac{27}{36}$  to lowest terms.

JIM  $\frac{27 \div 9}{36 \div 9} = \frac{3}{4}$

4. How would Jim have changed  $\frac{9}{36}$  to lowest terms?

5. Jane said it was all right to show the division as Jim did when he changed  $\frac{27}{36}$  to lowest terms, but there was a shorter way. Look at Jane's shorter way. Why did she cross out 9 and write 1? Why did she cross out 36 and write 4?

JANE

OLD WAY

$$\frac{9 \div 9}{36 \div 9} = \frac{1}{4}$$

SHORTER WAY

$$\frac{\cancel{9}^1}{\cancel{36}_4} = \frac{1}{4}$$

6. Copy. Use Jane's way to change to lowest terms.

$$\frac{4}{8} \quad \frac{4}{6} \quad \frac{8}{12} \quad \frac{10}{15} \quad \frac{16}{24} \quad \frac{14}{16}$$

Alice said, "When I change a fraction to lowest terms, I do not divide as Jim or Jane did. I think the division. When I find the new numerator, I write it in the new fraction. I do the same when I find the new denominator."



**THINK:** The largest number by which 18 and 24 can be divided evenly is 6.  $18 \div 6 = 3$ .

Write 3 as the new numerator.

**THINK:**  $24 \div 6 = 4$ . Write 4 as the new denominator.

**ALICE**

$$\frac{18}{24} = \frac{3}{4}$$

Copy. Change to lowest terms, using Alice's way. If you find it too difficult, show the dividing as Jane did.

7.  $\frac{9}{24}$     $\frac{15}{25}$     $\frac{16}{20}$     $\frac{12}{16}$     $\frac{9}{21}$     $\frac{6}{15}$

8.  $\frac{8}{32}$     $\frac{9}{15}$     $\frac{4}{28}$     $\frac{21}{24}$     $\frac{7}{35}$     $\frac{15}{20}$

■ When a fraction is changed to an equal fraction having a smaller denominator and a smaller numerator, the fraction has been changed to **lower terms**.

Four girls had  $\frac{3}{4}$  lb. of popcorn. They wanted to share it so that each would have an equal part. Carol said, "We can't each have  $\frac{1}{4}$  lb., because there are only  $\frac{3}{4}$  lb. to share."

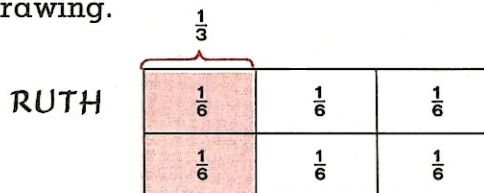
Sue said, "We could change  $\frac{3}{4}$  lb. to an equal fraction showing sixteenths of a pound." She wrote this.

|            |                              |                                                 |
|------------|------------------------------|-------------------------------------------------|
| <b>SUE</b> | $\frac{3}{4} = \frac{?}{16}$ | $\frac{4 \times 3}{4 \times 4} = \frac{12}{16}$ |
|------------|------------------------------|-------------------------------------------------|

9. Explain what Sue did to change  $\frac{3}{4}$  to  $\frac{12}{16}$ .

10. How many sixteenths of a pound would each girl get?

11. Ruth made this drawing to show that  $\frac{1}{3}$  equals  $\frac{2}{6}$ . Study her drawing.



In changing  $\frac{1}{3}$  to  $\frac{2}{6}$  what happens to the size of the parts? What happens to the number of parts? If you did not have Ruth's picture, how would you know the answer to these questions by just looking at the fractions  $\frac{1}{3}$  and  $\frac{2}{6}$ ?

■ When a fraction is changed to an equal fraction having a larger denominator and larger numerator, the fraction has been changed to **higher terms**.

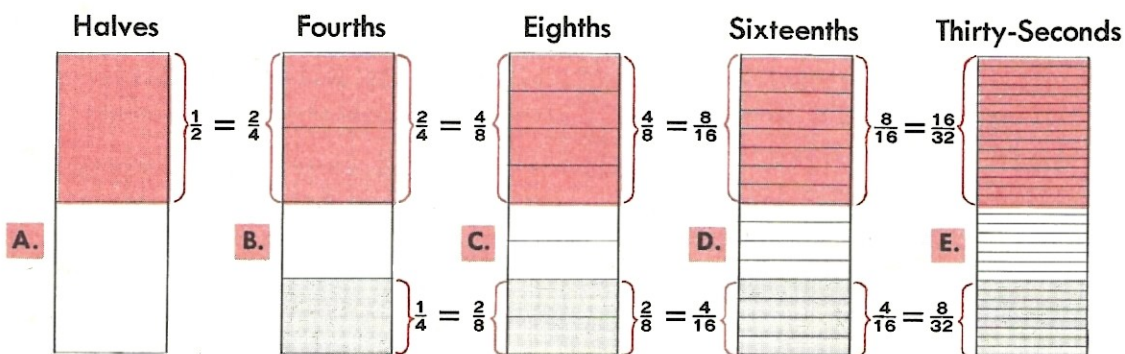
Copy. Change to higher terms.

12.  $\frac{3}{5} = \frac{?}{10}$     $\frac{5}{6} = \frac{?}{12}$     $\frac{2}{3} = \frac{?}{6}$

13.  $\frac{3}{4} = \frac{?}{8}$     $\frac{7}{8} = \frac{?}{24}$     $\frac{2}{3} = \frac{?}{12}$

■ Multiplying or dividing both terms of a fraction by the **same** number does not change the value of a fraction.

■ You can always change a fraction to an equal fraction by multiplying or dividing both terms by the **same** number.



### Learning About Changing the Form of a Fraction

Jack made these drawings to help him answer some review questions about fractions.

1. In which drawing are the equal parts the largest? Which drawing has the smallest number of equal parts?

2. Drawing E shows the whole divided into 32 equal parts. Each equal part is what part of the whole?

3. In the fractions  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{1}{16}$ , which term of the fraction shows the number of equal parts into which the whole is divided?

4. Jack drew A, B, C, D, and E equal in size. He said that as he made the equal parts in the whole smaller, the denominator of the fraction became larger. Why?

5. Jack said that  $\frac{4}{16}$  and  $\frac{8}{32}$  are equal fractions. If you did not have his drawings, how could you find out if he was right?

6. Ruth was looking at Jack's drawings. She said that  $\frac{2}{8}$  and  $\frac{4}{8}$  were **like fractions**. What did she mean? Find some other like fractions in Jack's drawings.

7. The fractions  $\frac{1}{2}$ ,  $\frac{8}{32}$ ,  $\frac{8}{16}$ , and  $\frac{2}{8}$  are **unlike fractions**. How can you tell that they are unlike?

■ Fractions having the same denominator are **like fractions**.

■ Fractions having different denominators are **unlike fractions**.

8. Write three unlike fractions that equal  $\frac{1}{2}$ .

9. Write two unlike fractions that are equal to  $\frac{8}{16}$  but are in lower terms than  $\frac{8}{16}$ .

Copy. Write the missing numerators.

10.  $\frac{8}{12} = \frac{?}{3}$        $\frac{2}{8} = \frac{?}{32}$        $\frac{6}{8} = \frac{?}{4}$

11.  $\frac{3}{4} = \frac{?}{16}$        $\frac{10}{12} = \frac{?}{24}$        $\frac{14}{16} = \frac{?}{8}$

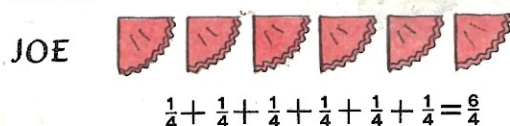


## Changing Improper Fractions to Simplest Form

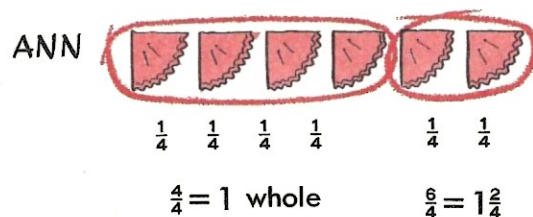


Jane baked 2 pies. She served  $\frac{1}{4}$  of a pie to each person. If 6 persons ate pie, how many of her pies were eaten?

1. Joe drew this picture to show Jane how many of her pies were eaten.



2. Ann said that Joe's answer was not in simplest form. She said it was an improper fraction and it could be changed to a mixed number that would show how many whole pies and what part of another pie had been eaten. Explain Ann's drawing and her work.



3. Tom said that Ann's answer was still not in simplest form. He

said the fraction  $\frac{2}{4}$  should be written in lowest terms. Write  $1\frac{2}{4}$  with the fraction in lowest terms.

4. If you were changing the improper fraction  $\frac{10}{6}$  to a mixed number, how many wholes would there be in the mixed number? By what number would you divide the numerator? Why? How many sixths would you have left over? Write  $\frac{10}{6}$  as a mixed number with the fraction in lowest terms.

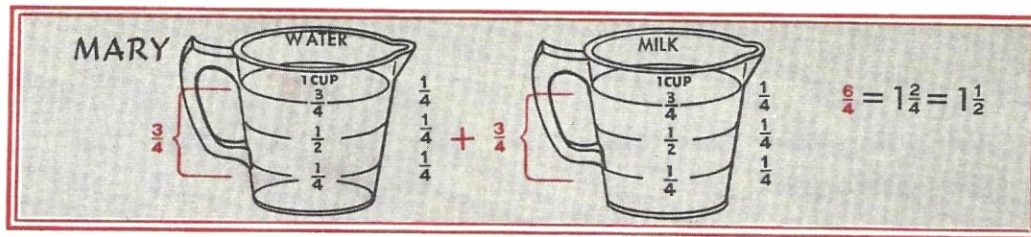
5. How many wholes equal  $\frac{15}{5}$ ? Make a drawing if you are not sure.

Change these improper fractions to wholes or mixed numbers in simplest form.

6.  $\frac{12}{4}$     $\frac{10}{3}$     $\frac{15}{12}$     $\frac{18}{4}$     $\frac{11}{6}$     $\frac{14}{4}$

7.  $\frac{8}{2}$     $\frac{12}{8}$     $\frac{21}{9}$     $\frac{15}{6}$     $\frac{16}{3}$     $\frac{9}{2}$

■ To change an improper fraction to a whole or mixed number, divide the numerator of the fraction by the denominator. If there is a left over fraction, change this fraction to lowest terms.



### Adding Like Fractions

Jean mixed  $\frac{3}{4}$  of a cup of milk and  $\frac{3}{4}$  of a cup of water together in a bowl. How many cupfuls of the mixture were there in the bowl?

1. Mary used the measuring cup to find her answer. She found that  $\frac{3}{4}$  cup of water was the same as  $\frac{1}{4}$ ,  $\frac{1}{4}$ , and  $\frac{1}{4}$  cup. She knew then that  $\frac{3}{4}$  cup of milk was the same as  $\frac{1}{4}$ ,  $\frac{1}{4}$ , and  $\frac{1}{4}$  cup. She counted and found that there were  $\frac{6}{4}$ , or  $1\frac{1}{2}$  cups in the mixture. Was she right?

2. Jack said, "The fractions  $\frac{3}{4}$  and  $\frac{3}{4}$  are **like** fractions. They have the same denominator. When I add these fractions, I can write the word fourths instead of writing the denominator 4."

JACK  $\frac{3}{4} + \frac{3}{4} =$   
3 fourths + 3 fourths = 6 fourths

What did Jack forget to do after he added?

3. Jean said, "The numerators of like fractions show how many equal parts are to be added. There are 3 of the equal parts in each  $\frac{3}{4}$ ."

To find the sum of these like fractions, I add the numerators."

JEAN  $\frac{3}{4} + \frac{3}{4} = \frac{3+3}{4} = \frac{6}{4} = 1\frac{2}{4} = 1\frac{1}{2}$

4. Tom said, "Jean's way is too long. You can think some of the work that Jean wrote." Tom showed two shorter ways. Why are they shorter than Jean's way?

TOM

A.  $\frac{3}{4} + \frac{3}{4} = \frac{6}{4} = 1\frac{2}{4} = 1\frac{1}{2}$

B.  $\frac{3}{4}$   
 $+\frac{3}{4}$   
 $\hline \frac{6}{4} = 1\frac{2}{4} = 1\frac{1}{2}$

► Copy. Add. Use either of Tom's ways.

5.  $\frac{2}{3} + \frac{2}{3} = \square$   $\frac{1}{5} + \frac{3}{5} = \square$   $\frac{3}{8} + \frac{5}{8} = \square$

6.  $\frac{5}{12} + \frac{1}{12} = \square$   $\frac{4}{6} + \frac{5}{6} = \square$   $\frac{4}{9} + \frac{7}{9} = \square$

7.  $\frac{5}{16} + \frac{7}{16} = \square$   $\frac{7}{8} + \frac{5}{8} = \square$   $\frac{4}{5} + \frac{3}{5} = \square$   $\frac{2}{9} + \frac{4}{9} = \square$   $\frac{7}{12} + \frac{9}{12} = \square$

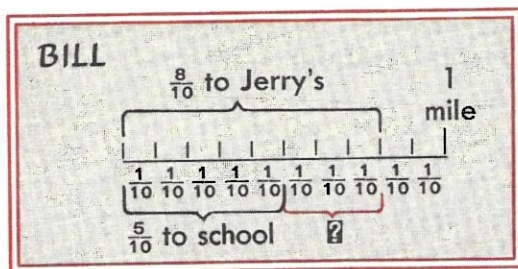
8.  $\frac{5}{6} + \frac{5}{6} = \square$   $\frac{9}{16} + \frac{11}{16} = \square$   $\frac{11}{12} + \frac{5}{12} = \square$   $\frac{4}{7} + \frac{1}{7} = \square$   $\frac{5}{10} + \frac{9}{10} = \square$



## Subtracting Like Fractions



1. Bill and Jerry were deciding where to meet to start on a trip. Bill said, "It is  $\frac{8}{10}$  mi. from my house to your house. It is only  $\frac{5}{10}$  mi. from my house to school. I will have  $\frac{3}{10}$  mi. less to ride if I meet you at school." Explain the drawing Bill made to show the difference.



2. Jerry found the difference between  $\frac{8}{10}$  mi. and  $\frac{5}{10}$  mi. by subtracting. Study Jerry's work and give a rule for subtracting like fractions.

**JERRY**

$$\begin{array}{r} \frac{8}{10} \\ - \frac{5}{10} \\ \hline \frac{3}{10} \end{array}$$

3. Ann drew a line  $\frac{7}{8}$  in. long. She erased  $\frac{3}{8}$  in. from this line. How long was the line that was left? Use your ruler to find the answer. Write the answer in simplest form.

4. Show the subtraction for problem 3 using Jerry's way.

■ To add or subtract like fractions, add or subtract the numerators. Write the answer in simplest form.

► Copy. Find the differences. Write answers in lowest terms.

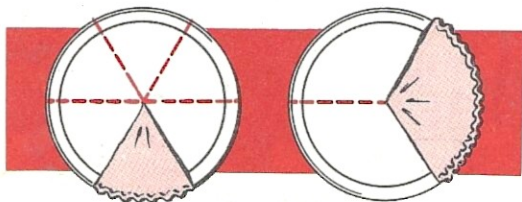
5.  $\frac{5}{6} - \frac{4}{6} = \frac{1}{6}$      $\frac{5}{7} - \frac{1}{7} = \frac{4}{7}$      $\frac{3}{4} - \frac{2}{4} = \frac{1}{4}$      $\frac{7}{8} - \frac{5}{8} = \frac{2}{8} = \frac{1}{4}$      $\frac{8}{9} - \frac{5}{9} = \frac{3}{9} = \frac{1}{3}$

6.  $\frac{3}{5} - \frac{1}{5} = \frac{2}{5}$      $\frac{5}{8} - \frac{3}{8} = \frac{2}{8} = \frac{1}{4}$      $\frac{7}{9} - \frac{2}{9} = \frac{5}{9}$      $\frac{11}{12} - \frac{5}{12} = \frac{6}{12} = \frac{1}{2}$      $\frac{5}{6} - \frac{1}{6} = \frac{4}{6} = \frac{2}{3}$

7.  $\frac{15}{16} - \frac{5}{16} = \frac{10}{16} = \frac{5}{8}$      $\frac{17}{24} - \frac{7}{24} = \frac{10}{24} = \frac{5}{12}$      $\frac{7}{12} - \frac{3}{12} = \frac{4}{12} = \frac{1}{3}$      $\frac{7}{8} - \frac{2}{8} = \frac{5}{8}$      $\frac{9}{10} - \frac{3}{10} = \frac{6}{10} = \frac{3}{5}$

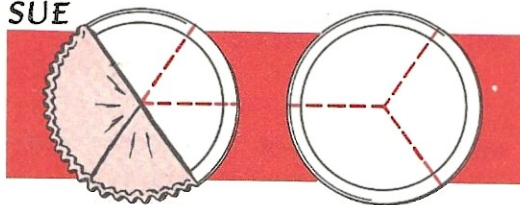
## Adding and Subtracting Unlike Fractions

After the dinner guests had gone, Bob said, "I wonder how much pie is left in the kitchen." He went into the kitchen and saw that a part of each pie was left.



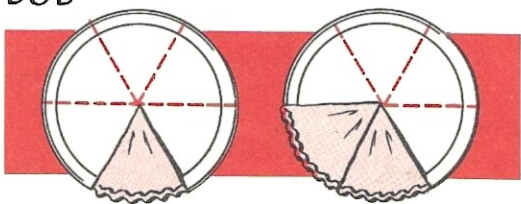
1. Sue said, "The size of the pieces of pie is not the same. I do not know how to add  $\frac{1}{6}$  and  $\frac{2}{3}$ , but I can find what part of a pie is left if I put all the pieces in the same pie pan." She did and found there was what part of a pie left?

SUE



2. Bob said, "You can add unlike fractions if you change them into like fractions. When I look at  $\frac{1}{3}$  of the pie, I see it equals  $\frac{2}{6}$ ."

BOB



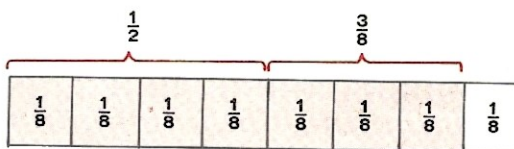
Here is what Bob thought when he added the two fractions.

BOB

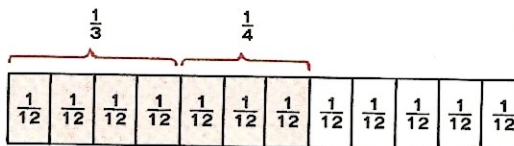
$$\begin{array}{r} \frac{1}{6} = \\ + \frac{1}{3} = + \frac{2}{6} \\ \hline \frac{3}{6} = \frac{1}{2} \end{array}$$

To what equal fraction did Bob change  $\frac{1}{3}$ ? What is the denominator in the fractions  $\frac{1}{6}$  and  $\frac{2}{6}$ ?

3. What does this drawing show you about  $\frac{1}{2} + \frac{3}{8}$ ?



4. Use the drawing below to explain what you would have to do to add  $\frac{1}{3}$  and  $\frac{1}{4}$ .



5. What like or **common** denominator did Bob use when he added  $\frac{1}{6} + \frac{1}{3}$  in problem 2?

6. What common denominator do you use in adding  $\frac{1}{2} + \frac{3}{8}$ ? In adding  $\frac{1}{3} + \frac{1}{4}$ ?

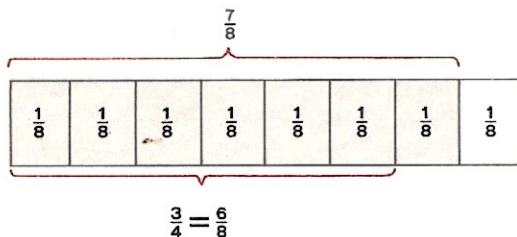


|                                                                                                                                      |                                                                                                                                                                               |                                                                                                                     |                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <p><b>A.</b></p> $\begin{array}{r} \frac{5}{16} \\ \frac{2}{16} \\ + \frac{7}{16} \\ \hline \frac{14}{16} = \frac{7}{8} \end{array}$ | <p><b>B.</b></p> $\begin{array}{r} \frac{1}{6} = \frac{2}{12} \\ \frac{1}{3} = \frac{4}{12} \\ + \frac{1}{4} = \frac{3}{12} \\ \hline \frac{9}{12} = \frac{3}{4} \end{array}$ | <p><b>C.</b></p> $\begin{array}{r} \frac{7}{10} \\ - \frac{3}{10} \\ \hline \frac{4}{10} = \frac{2}{5} \end{array}$ | <p><b>D.</b></p> $\begin{array}{r} \frac{7}{8} = \frac{7}{8} \\ - \frac{3}{4} = \frac{6}{8} \\ \hline \frac{1}{8} \end{array}$ |
|--------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|

7. Use Bob's way. Add  $\frac{1}{2} + \frac{3}{8}$ . Add  $\frac{1}{3} + \frac{1}{4}$ .

8. Look at the drawing that Ann made to show  $\frac{7}{8} - \frac{3}{4} = \frac{1}{8}$ . Then explain subtraction D at the top of this page.

ANN



9. Why are addition A and subtraction C very easy to do?

10. What must you do before you can add or subtract in B and D?

■ Before unlike fractions can be added or subtracted, they must be changed so they have the same denominator. This is called changing to a **common denominator**.

11. Make a drawing for each

addition below. Then copy and complete the example.

|                                                                                                                                |                                                                                                                                   |                                                                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <p><b>E.</b></p> $\begin{array}{r} \frac{1}{4} = \frac{1}{4} \\ + \frac{1}{2} = \frac{2}{4} \\ \hline \frac{3}{4} \end{array}$ | <p><b>F.</b></p> $\begin{array}{r} \frac{1}{2} = \frac{5}{10} \\ + \frac{2}{5} = \frac{4}{10} \\ \hline \frac{9}{10} \end{array}$ | <p><b>G.</b></p> $\begin{array}{r} \frac{2}{3} = \frac{?}{12} \\ + \frac{1}{4} = \frac{?}{12} \\ \hline \frac{?}{12} \end{array}$ |
|--------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|

12. Make a drawing for each subtraction below. Then copy and complete the subtraction.

|                                                                                                                                |                                                                                                                                    |                                                                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <p><b>H.</b></p> $\begin{array}{r} \frac{5}{8} = \frac{5}{8} \\ - \frac{1}{4} = \frac{2}{8} \\ \hline \frac{3}{8} \end{array}$ | <p><b>I.</b></p> $\begin{array}{r} \frac{2}{3} = \frac{?}{12} \\ - \frac{5}{12} = \frac{?}{12} \\ \hline \frac{?}{12} \end{array}$ | <p><b>J.</b></p> $\begin{array}{r} \frac{5}{6} = \frac{?}{12} \\ - \frac{3}{4} = \frac{?}{12} \\ \hline \frac{?}{12} \end{array}$ |
|--------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|

13. Study examples B, D, E, F, G, H, I, and J. In which of these could you use the denominator of one of the fractions as the common denominator? In which of these did you have to use a denominator not given in the example?

14. Tell how you would think to find the common denominator in examples F, G, and J.

## Practice in Adding and Subtracting Fractions

When you have two fractions and need to find the smallest common denominator, use these easy steps.

- Find out if the larger denominator is the common denominator.
- If it is not, try 2 times the larger denominator.
- If 2 times the larger denominator is not the common denominator, try 3 times the larger denominator, and so on, until you find a number that will contain both denominators an exact number of times.
- If you have more than two denominators, use the largest given denominator and take the steps given above until you find the smallest number that will exactly contain all the given denominators.

Here is another easy way to find the lowest common denominator.

- Write the denominators of all the fractions. (See below.)
- Cross out any of these denominators that are contained evenly in the largest one of the denominators.
- Multiply the denominators that are left to find a common denominator. This may be the lowest common denominator.
- Test the number. Divide it by 2 or 3, or both. Test until you find the lowest number that will contain all the denominators an exact number of times.

|                      |                               |
|----------------------|-------------------------------|
| <del>8</del> × 8 × 6 | $\frac{1}{3} = \frac{8}{24}$  |
| (Cross out 3.)       | $\frac{1}{8} = \frac{3}{24}$  |
| $8 \times 6 = 48$    | $\frac{1}{6} = \frac{4}{24}$  |
| $48 \div 2 = 24$     | $\frac{2}{24} = \frac{1}{12}$ |

► Copy. Add. Write answers in lowest terms.

$$1. \quad \frac{3}{8} + \frac{1}{2} + \frac{2}{3} + \frac{1}{4} + \frac{3}{5}$$

► Copy. Subtract. Write answers in lowest terms.

$$2. \quad \frac{11}{16} - \frac{2}{3} - \frac{4}{5} - \frac{1}{2} - \frac{5}{6}$$

► Copy. Find the answers. Write answers in lowest terms.

$$3. \quad \frac{1}{4} + \frac{1}{8} + \frac{1}{2} + \frac{2}{3} + \frac{1}{3}$$

$$4. \quad \frac{5}{6} - \frac{1}{6} + \frac{7}{12} - \frac{7}{8} - \frac{3}{4} + \frac{5}{6}$$

$$5. \quad \frac{2}{5} + \frac{7}{9} - \frac{11}{12} + \frac{3}{8} - \frac{5}{6} + \frac{3}{4}$$



## Adding Mixed Numbers

One pound serves 6

Fourth Grade — 26 pupils

$$4\frac{2}{6} = 4\frac{1}{3} \text{ lb.}$$

$$6 \overline{) 26}$$

Fifth Grade — 27 pupils

$$4\frac{3}{6} = 4\frac{1}{2} \text{ lb.}$$

$$6 \overline{) 27}$$

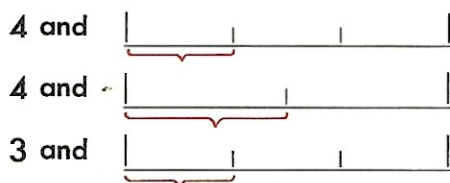
Sixth Grade — 20 pupils

$$3\frac{2}{6} = 3\frac{1}{3} \text{ lb.}$$

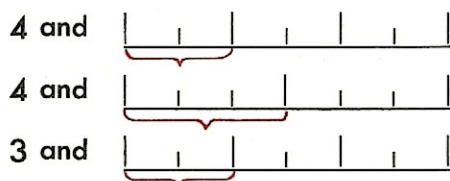
$$6 \overline{) 20}$$

1. The hamburger committee for the school picnic did the work shown above. What figures need to be added to find how many pounds of hamburger the committee needs to buy?

2. Jim was not sure that his total was right. He wrote these figures and made these drawings. Explain his number-line drawings.

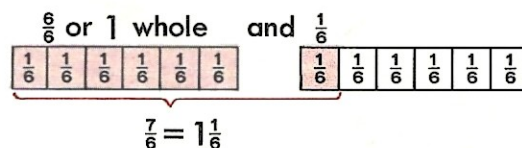


3. Jim changed the  $\frac{1}{3}$ ,  $\frac{1}{2}$ , and  $\frac{1}{3}$  in his drawings to sixths. Is  $\frac{1}{2}$  equal to  $\frac{3}{6}$ ?



4. From his drawing, Jim found that the fractions when put together were equal to  $\frac{7}{6}$ . He made

this drawing and found that the improper fraction  $\frac{7}{6}$  is 1 whole and  $\frac{1}{6}$  over, or  $1\frac{1}{6}$ .



Give a rule that Jim could have used in changing the improper fraction  $\frac{7}{6}$  to the mixed number  $1\frac{1}{6}$ . (See page 79.)

5. Explain the work that Jim did when he added the mixed number in this way.

JIM

$$\begin{array}{r} 4\frac{1}{3} = 4\frac{2}{6} \\ 4\frac{1}{2} = 4\frac{3}{6} \\ + 3\frac{1}{3} = + 3\frac{2}{6} \\ \hline 11\frac{7}{6} = 11 \text{ and } 1\frac{1}{6} = 12\frac{1}{6} \end{array}$$

► Copy. Add, using figures only. Write answers in simplest form.

6.  $2\frac{1}{2} + 2\frac{3}{4}$      $8\frac{1}{5} + 2\frac{9}{10}$      $1\frac{1}{3} + 2\frac{5}{6}$      $14\frac{1}{2} + 3\frac{1}{6}$

7.  $3\frac{3}{4} + 1\frac{2}{3}$      $13\frac{7}{16} + 4\frac{3}{8}$      $20\frac{3}{4} + 11\frac{5}{6}$      $12\frac{1}{8} + 10\frac{1}{4}$

## Subtracting Mixed Numbers

Mary had  $3\frac{1}{6}$  yd. of cloth. She wanted to figure how much goods she would have left if she used  $1\frac{2}{3}$  yd. to make an apron.

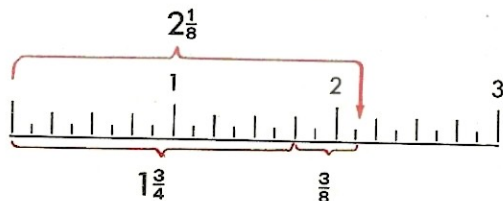
She knew she could subtract to see how many yards she would have left. This is what she wrote.

$$\begin{array}{r} \text{MARY} \quad 3\frac{1}{6} = 3\frac{1}{6} \\ - 1\frac{2}{3} = -1\frac{4}{6} \\ \hline \end{array}$$

Mary could not find the answer. She thought, "I cannot subtract  $\frac{4}{6}$  from  $\frac{1}{6}$ ."

1. How could Mary change  $3\frac{1}{6}$  so she could subtract? Find the answer to the subtraction.

2. Jean made this drawing to show that  $2\frac{1}{8}$  less  $1\frac{3}{4}$  equals  $\frac{3}{8}$ . Is her work correct? Check Jean's answer, using figures only.



3. Make a drawing to show that  $2\frac{14}{9}$  is equal to  $3\frac{5}{9}$ .

4. Make a drawing to show the difference between  $5\frac{1}{3}$  and  $1\frac{1}{2}$ .

5. Jerry found the difference between  $5\frac{1}{3}$  and  $1\frac{1}{2}$  by subtracting. Explain what he did to find the difference.

JERRY

$$\begin{array}{r} 5\frac{1}{3} = 5\frac{2}{6} \\ - 1\frac{1}{2} = -1\frac{3}{6} \\ \hline 3\frac{5}{6} \end{array}$$

► Copy and finish these subtractions.

$$\begin{array}{r} 6. \quad 4\frac{1}{5} = 3\frac{2}{5} \\ - 2\frac{3}{5} = -2\frac{3}{5} \\ \hline \end{array}$$

$$\begin{array}{r} 7. \quad 9 = 8\frac{2}{10} \\ - 5\frac{7}{10} = -5\frac{7}{10} \\ \hline \end{array}$$

$$\begin{array}{r} 8. \quad 7\frac{5}{8} = 7\frac{5}{8} = 6\frac{2}{8} \\ - 3\frac{3}{4} = -3\frac{6}{8} = -3\frac{6}{8} \\ \hline \end{array}$$

$$\begin{array}{r} 9. \quad 10\frac{2}{3} = 10\frac{8}{12} = 9\frac{2}{12} \\ - 6\frac{3}{4} = -6\frac{9}{12} = -6\frac{9}{12} \\ \hline \end{array}$$

► Copy. Find the answers. Write answers in simplest form.

$$\begin{array}{r} 10. \quad 7\frac{5}{8} \quad 5\frac{3}{4} \quad 6\frac{1}{2} \quad 8 \\ - 4\frac{1}{8} \quad - 2\frac{1}{2} \quad - 3\frac{7}{10} \quad - 3\frac{5}{6} \\ \hline \end{array}$$

$$\begin{array}{r} 11. \quad 14\frac{1}{5} \quad 12\frac{1}{2} \quad 24\frac{3}{8} \quad 16\frac{2}{3} \\ - 6\frac{3}{10} \quad - 5\frac{2}{3} \quad - 12\frac{2}{3} \quad - 7\frac{11}{12} \\ \hline \end{array}$$



## Problems Using Fractions

1. Carol bought  $1\frac{1}{3}$  yd. of blue ribbon,  $1\frac{1}{2}$  yd. of pink ribbon, and  $\frac{1}{6}$  yd. of white ribbon. How many yards of ribbon did she buy?

2. The grocer had a piece of cheese weighing  $4\frac{1}{8}$  lb. He sold  $1\frac{3}{4}$  lb. from this piece to Mrs. Mills. What was the weight of the piece of cheese after Mrs. Mills had made her purchase?

3. Bill's father bought a  $5\frac{1}{4}$ -lb. roast, but  $3\frac{1}{3}$  lb. would have been enough. How many pounds were not needed?

4. A recipe for making punch calls for  $3\frac{1}{3}$  cups of lemon juice and  $4\frac{1}{4}$  cups of orange juice. How much juice in all was required for the punch?

5. Jane traveled  $4\frac{3}{5}$  miles to and from school each day. Bill had to travel  $3\frac{1}{2}$  miles a day. How much farther did Jane travel?

6. Bill had three boards measuring  $6\frac{1}{2}$  ft.,  $4\frac{1}{4}$  ft., and  $11\frac{1}{3}$  ft. If he laid these boards end to end to make a walk, how long would the walk be?

## Proving Number Statements

To prove subtraction, Bob used this way. Can you explain what he did?

|                                                         |                                                         |
|---------------------------------------------------------|---------------------------------------------------------|
| BOB                                                     |                                                         |
| $\begin{array}{r} 231 \\ -198 \\ \hline 33 \end{array}$ | $\begin{array}{r} 231 \\ -33 \\ \hline 198 \end{array}$ |

► Copy. Find the answers. Use Bob's way to check your subtraction.

$$\begin{array}{r} 1. \quad 275 \quad 409 \quad 364 \quad 971 \\ \quad -168 \quad -296 \quad -152 \quad -889 \end{array}$$

$$\begin{array}{r} 2. \quad 800 \quad 504 \quad 730 \quad 369 \\ \quad -519 \quad -204 \quad -329 \quad -159 \end{array}$$

|     |                                                                    |                                                                                                                    |
|-----|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| DON | $\begin{array}{r} 36 \\ 45 \\ 72 \\ +63 \\ \hline 216 \end{array}$ | $\begin{array}{r} \cancel{36} \\ \cancel{45} \\ 72 \\ +63 \\ \hline \cancel{216} \\ +36 \\ \hline 216 \end{array}$ |
|-----|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|

Don used the mark-out check to make sure that he added correctly. Explain this check.

► Copy. Add. Use Don's way to check your answers.

$$\begin{array}{r} 3. \quad 45 \quad 63 \quad 912 \quad 456 \\ \quad 78 \quad 48 \quad 417 \quad 987 \\ \quad 63 \quad 24 \quad 635 \quad 243 \\ \quad +81 \quad +72 \quad +753 \quad +334 \end{array}$$

### Taking Stock — Test 3



You can use this test to find out how well you are keeping up your skill in addition, subtraction, multiplication, and division.

Your teacher will tell you when to begin and when to stop.

In Parts I and II, use folded paper for writing the sums and differences. In Parts III and IV, copy and find the answers.

#### PART I ADDITION

|              |              |              |
|--------------|--------------|--------------|
| 1. 4820      | 3694         | 4790         |
| 6312         | 7206         | 6321         |
| 9571         | 5804         | 4288         |
| 5043         | 3223         | 6914         |
| <u>+2765</u> | <u>+6975</u> | <u>+5300</u> |

|              |              |              |
|--------------|--------------|--------------|
| 2. 6856      | 3561         | 7854         |
| 3405         | 4196         | 6215         |
| 4963         | 8284         | 4306         |
| 6027         | 2136         | 5418         |
| <u>+4185</u> | <u>+9704</u> | <u>+2772</u> |

|              |              |              |
|--------------|--------------|--------------|
| 3. 7165      | 4863         | 3460         |
| 4520         | 6034         | 8145         |
| 3643         | 4587         | 3223         |
| 8927         | 7206         | 4196         |
| <u>+3385</u> | <u>+6568</u> | <u>+2052</u> |

#### PART II SUBTRACTION

|               |               |               |
|---------------|---------------|---------------|
| 4. 49723      | 87291         | 97343         |
| <u>-32935</u> | <u>-26918</u> | <u>-32794</u> |

|               |               |               |
|---------------|---------------|---------------|
| 5. 56427      | 36904         | 66000         |
| <u>-29815</u> | <u>-21084</u> | <u>-49316</u> |

|               |               |               |
|---------------|---------------|---------------|
| 6. 76429      | 95621         | 87238         |
| <u>-40000</u> | <u>-30952</u> | <u>-42541</u> |

#### PART III MULTIPLICATION

|             |             |             |             |
|-------------|-------------|-------------|-------------|
| 7. 424      | 685         | 879         | 603         |
| <u>×152</u> | <u>×304</u> | <u>×200</u> | <u>×475</u> |

|            |            |            |
|------------|------------|------------|
| 8. 5805    | 7463       | 9229       |
| <u>×65</u> | <u>×29</u> | <u>×74</u> |

|            |            |            |
|------------|------------|------------|
| 9. 4972    | 6750       | 8300       |
| <u>×48</u> | <u>×20</u> | <u>×60</u> |

#### PART IV DIVISION

|              |          |
|--------------|----------|
| 10. 43)87634 | 62)12524 |
|--------------|----------|

|              |          |
|--------------|----------|
| 11. 29)62930 | 54)59616 |
|--------------|----------|

|              |          |
|--------------|----------|
| 12. 72)76536 | 47)51982 |
|--------------|----------|

|              |          |
|--------------|----------|
| 13. 32)71680 | 18)54720 |
|--------------|----------|

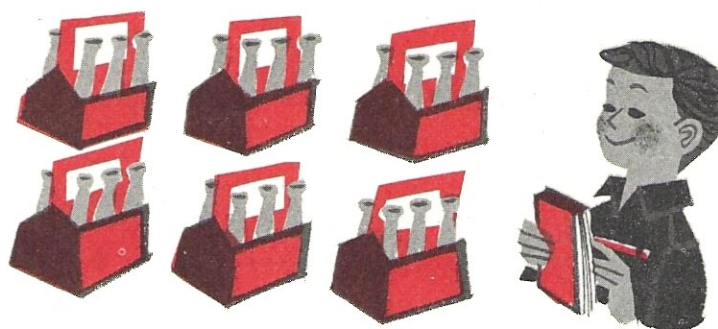
|              |          |
|--------------|----------|
| 14. 83)16932 | 96)22080 |
|--------------|----------|

Check your answers with the right ones. Write your total score at the top of your paper.

Take out your record sheet for the "Taking Stock" tests. In the column for Test 3, color or shade as many places as equal your score for this test.



## Counting Up and Counting Down



1. The picture above shows some bottles that Joe was going to count. He counted by 6's. What numbers did he say?

2. How many 6's equal 96? Count by 6's to check your answer.

3. Below are some counting exercises. Count up by 4's, 5's, or 6's. You can tell from the first two numbers in the exercise the number you are to use in counting. Write only the last number on your paper.

51 57 2 2 2 2 2

40 44 2 2 2 2 2

59 63 2 2 2 2 2

36 41 2 2 2 2 2

90 95 2 2 2 2 2

16 22 2 2 2 2 2

24 30 2 2 2 2 2

15 19 2 2 2 2 2

4. If you count up by 7's 100 times, what is the last number? Can you tell without actually counting?

5. If you count up by 20's 10 times, what is the last number?

6. Ann gave the class this problem. "An elevator operator stopped at the 67th floor of a skyscraper. On his way down he stopped next at the 61st floor. Each time on his way down he passed the same number of floors before stopping. How many stops in all had he made when he stopped at the first floor?"

Jim's answer was 10 and Sue's was 11. Ann said, "Both of you are wrong. You counted down by 6's, but you did not answer the question." What is the answer?

7. Below are more counting exercises. Find the number you are to use in counting. Write only the last number on your paper.

62 58 54 2 2 2 2

94 90 86 2 2 2 2

113 108 103 2 2 2 2

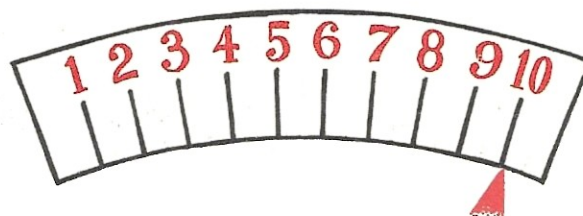
500 495 490 2 2 2 2

106 100 94 2 2 2 2

85 79 73 2 2 2 2

68 62 56 2 2 2 2

## How Well Have You Learned?



1. Round the numbers below to the nearest million.

157,383,423      498,501,000

259,693,472      227,650,356

2. Mary paid \$14.89 for a dress and \$9.95 for a pair of shoes. How much did she spend for these? Estimate the answer. Then find the exact answer.

3. Count up by 4, 5, or 6. The first two numbers in a row will help you to know which number to add. Write the last number on your paper.

62    67    2    2    2    2    2

34    40    2    2    2    2    2

100    104    2    2    2    2    2

200    205    2    2    2    2    2

76    82    2    2    2    2    2

4. Count down by 4, 5, or 6. Write the last number on your paper.

44    39    2    2    2    2    2

32    28    2    2    2    2    2

50    44    2    2    2    2    2

72    66    2    2    2    2    2

76    71    2    2    2    2    2

5. Make a drawing to show the difference between  $2\frac{1}{3}$  and  $1\frac{5}{6}$ .

6. Make a drawing to show the difference between 4 and  $1\frac{5}{8}$ . Use four circles to show the difference. How many of these circles must you divide into eighths before you can subtract  $1\frac{5}{8}$  from 4?

7. Change these fractions to simplest form.

$\frac{6}{10}$      $\frac{14}{18}$      $\frac{8}{12}$      $5\frac{12}{32}$      $16\frac{24}{36}$

8. Tom was asked to count up to 4 by  $\frac{2}{3}$ . He wrote:

$\frac{2}{3}$      $\frac{4}{3}$      $\frac{6}{3}$      $\frac{8}{3}$      $\frac{10}{3}$      $\frac{12}{3}$

Mary said Tom should have written:

$\frac{2}{3}$      $1\frac{1}{3}$     2     $2\frac{2}{3}$      $3\frac{1}{3}$     4

How is Mary's answer different from Tom's? Who gave the better answer?

Copy. Find the answers.

9.  $\begin{array}{r} \frac{5}{8} \\ \frac{1}{2} \\ + \frac{11}{16} \\ \hline \end{array}$      $\begin{array}{r} \frac{3}{4} \\ \frac{5}{6} \\ + \frac{2}{3} \\ \hline \end{array}$      $\begin{array}{r} 8\frac{1}{3} \\ 2\frac{1}{2} \\ + 5\frac{5}{8} \\ \hline \end{array}$      $\begin{array}{r} 15\frac{1}{5} \\ 24\frac{1}{2} \\ + 11\frac{7}{10} \\ \hline \end{array}$

10.  $\begin{array}{r} 3\frac{11}{10} \\ - 1\frac{4}{5} \\ \hline \end{array}$      $\begin{array}{r} 8\frac{1}{3} \\ - 5\frac{7}{12} \\ \hline \end{array}$      $\begin{array}{r} 17 \\ - 13\frac{3}{4} \\ \hline \end{array}$      $\begin{array}{r} 29\frac{1}{8} \\ - 11\frac{5}{6} \\ \hline \end{array}$



## Help Yourself to Improve

The exercises on this page will help you to practice what you have learned in this unit about fractions.

Copy. Find the answers. Write answers in simplest form. (85)

$$\begin{array}{r} 1. \quad 2\frac{1}{8} \quad 4\frac{2}{3} \quad 7\frac{2}{5} \quad 8\frac{2}{3} \\ + 3\frac{3}{8} \quad + 3\frac{3}{4} \quad + 3\frac{9}{10} \quad + 3\frac{5}{6} \end{array}$$

$$\begin{array}{r} 2. \quad 7\frac{5}{7} \quad 10\frac{4}{5} \quad 8\frac{3}{4} \quad 4\frac{7}{8} \\ + 2\frac{1}{2} \quad + 2\frac{3}{5} \quad + 9\frac{11}{16} \quad + 3\frac{1}{3} \end{array}$$

If you missed any of the exercises above because answers were not in simplest form, do example 3.

3. Change each to simplest form. (76)

$$\begin{array}{cccccc} \frac{2}{8} & 1\frac{4}{6} & \frac{3}{9} & 2\frac{9}{12} & \frac{17}{8} & \\ 4\frac{10}{16} & \frac{3}{6} & \frac{5}{15} & 3\frac{10}{25} & 4\frac{8}{24} & \end{array}$$

If you missed any exercises in 1 and 2 above because the common denominator was incorrect, do example 4.

4. Find the common denominator for each pair of fractions. (62)

$$\begin{array}{ccc} \frac{1}{4} + \frac{2}{5} & \frac{5}{8} + \frac{1}{4} & \frac{5}{9} + \frac{1}{3} \\ \frac{2}{3} + \frac{1}{6} & \frac{5}{6} + \frac{7}{12} & \frac{1}{4} + \frac{5}{16} \\ \frac{3}{8} + \frac{2}{3} & \frac{4}{9} + \frac{1}{2} & \frac{9}{10} + \frac{2}{5} \end{array}$$

5. Add the pairs of fractions given in example 4 above. (83)

Copy. Find the answers. Write each answer in simplest form. (86)

$$\begin{array}{r} 6. \quad 13\frac{1}{8} \quad 12\frac{1}{2} \quad 9\frac{2}{3} \quad 18\frac{2}{5} \\ - 2\frac{3}{4} \quad - 2\frac{5}{6} \quad - 3\frac{1}{4} \quad - 5\frac{3}{5} \end{array}$$

$$\begin{array}{r} 7. \quad 7\frac{2}{7} \quad 22\frac{1}{4} \quad 8\frac{5}{12} \quad 15\frac{3}{16} \\ - 3\frac{1}{2} \quad - 10\frac{1}{2} \quad - 6\frac{3}{4} \quad - 6\frac{1}{4} \end{array}$$

If you missed any of the answers above because you did not change a fraction to higher terms, do examples 8 and 9.

Change the fraction in each mixed number to higher terms. (77)

$$8. \quad 5\frac{1}{2} = 5\frac{2}{10} \quad 3\frac{7}{8} = 3\frac{2}{16}$$

$$9. \quad 3\frac{1}{4} = 3\frac{2}{24} \quad 9\frac{2}{3} = 8\frac{2}{9}$$

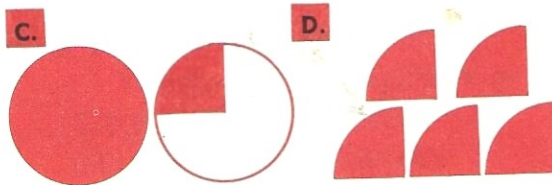
10. What is the difference between a proper and an improper fraction? (61)

11. What is wrong with A? With B? Copy and work each correctly. (85)

$$\begin{array}{r} A. \quad 8\frac{1}{2} = \frac{2}{4} \\ + 4\frac{1}{4} = \frac{1}{4} \\ \hline 12\frac{3}{4} \end{array}$$

$$\begin{array}{r} B. \quad 6\frac{1}{2} \\ + 2\frac{1}{4} \\ \hline 8\frac{2}{6} \text{ or } 8\frac{1}{3} \end{array}$$

12. Which drawing shows  $1\frac{1}{4}$ ? (61)



## Show That You Know



1. Which is largest?

$$\frac{3}{4} \text{ lb.} \quad \frac{12}{16} \text{ lb.} \quad \frac{6}{8} \text{ lb.}$$

2. Would you count fewer times if you counted by  $\frac{1}{2}$  to 5 than if you counted by  $\frac{1}{3}$  to 3?

3. If 306,407,824 were shown on a place-value frame, what places would have no marks?

4. Say or write a rule for adding **like fractions**.

Use the table below to answer the questions in problem 5.

| YEAR | NO. OF GAMES PLAYED | POINTS MADE |
|------|---------------------|-------------|
| 1st  | 7                   | 210         |
| 2nd  | 8                   | 215         |
| 3rd  | 7                   | 243         |
| 4th  | 9                   | 248         |
| 5th  | 9                   | 224         |

5. At the end of 5 years, what was the average number of games played per year according to the table? What was the average number of points made per year?

6. How many periods are there in each of these numbers?

$$\begin{array}{r} 90,345 \\ 355,205,822 \\ 836,482 \\ 9,462,841,500 \end{array}$$

7. What happens to the denominator when you add or subtract **like fractions**?

8. Write ten different fractions each of which equals  $\frac{1}{2}$ .

9. Write these mixed numbers as improper fractions:  $12\frac{1}{2}$   $6\frac{3}{4}$   $8\frac{1}{3}$

10. Write these improper fractions as mixed numbers:  $\frac{37}{12}$   $\frac{100}{3}$   $\frac{9}{5}$

11. Jack began with 5 and counted down by  $\frac{2}{3}$ . He said these fractions.

$$\frac{15}{3} \quad \frac{13}{3} \quad \frac{11}{3} \quad \frac{9}{3} \quad \frac{7}{3} \quad \frac{5}{3} \quad \frac{3}{3} \quad \frac{1}{3}$$

How did Jack get  $\frac{15}{3}$ ? Which of the fractions that he gave were not in simplest form? Rewrite Jack's fractions giving each in simplest form.

Copy. Find the answers in simplest form.

$$\begin{array}{r} 12. \quad \frac{3}{4} \quad \frac{5}{6} \quad 12\frac{1}{2} \quad 24\frac{2}{3} \\ \quad \frac{5}{8} \quad \frac{1}{2} \quad 6\frac{3}{4} \quad 16\frac{7}{8} \\ \quad +\frac{2}{3} \quad +\frac{3}{4} \quad +15\frac{9}{16} \quad +21\frac{5}{6} \end{array}$$

$$\begin{array}{r} 13. \quad 4\frac{3}{4} \quad 9\frac{2}{3} \quad 13\frac{3}{4} \quad 10\frac{3}{8} \\ \quad -2\frac{7}{8} \quad -6\frac{11}{12} \quad -5\frac{5}{6} \quad -7\frac{2}{3} \end{array}$$





# EXPLORING ARITHMETIC



$$\frac{3}{4} = .75 = 75\%$$

